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Picture on silk

In modern Japan, the traditional arts still apply. Not least in the manufacture of silk, the production of which is an important industry in Japan. Equally important to many Japanese farmers is the cultivation of mulberry leaves, sole food of the silkworm.

But mulberry leaves are as attractive to destructive pests as they are to silkworms, and it was estimated that 10% of the entire crop was annually lost to a variety of insects—particularly the larvae of the mulberry pyralid moth (*Margaronia pyloalis* Walker). These leaf-eating pests will attack right up to harvest-time and, for fear of destroying the silkworms also, insecticides which might leave toxic residues cannot be used. "*Shikata ga nai*", the Japanese farmers used to say, "There is nothing one can do about it".

Today, however, the picture on silk has changed. Tests with Phosdrin, Shell's new systemic insecticide, have shown that not only can a complete and rapid kill of the pyralid moth be obtained with concentrations as low as 0.025% to 0.05%, but that the mulberry leaves can be fed to the silkworms with perfect safety *within five days of application.* Phosdrin not only kills quickly—it is itself quickly dissipated into harmless compounds. This new Shell pesticide has a vast potential use on crops in all parts of the world threatened with close-to-harvest infestation.

Mulberry pyralid moth

(*Margaronia pyloalis* Walker)

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WALKDEN (H. H.) & NELSON (H. D.). **Evaluation of Methoxychlor for the Protection of stored Wheat and shelled Corn from Insect Attack.**— *Mktg. Res. Rep.* no. 213, vi + 25 pp., 2 figs., 4 refs., multigraph. Washington, D. C., Agric. Mktg. Serv., U.S. Dep. Agric., 1958.

The following is based on the authors' summary. This report contains the results of continuing tests with dusts of methoxy-DDT (methoxychlor) applied to stored grain for protection against insect attack, carried out between August 1953 and December 1956 on wheat and shelled maize stored in the standard circular 3,250-bushel metal bins of the Commodity Credit Corporation of the U.S. Department of Agriculture. After treatments had been applied, the grain was sampled monthly to determine the levels of insect population and moisture content and quarterly for chemical residue analysis, bioassay tests and commercial grading. In tests with wheat, the level of residue was also traced through the milling and baking processes.

Dusts applied to wheat in September and October 1955 at rates to give deposits of 5, 10 and 15 parts per million of methoxy-DDT practically eliminated the insects present and kept the wheat almost insect-free until December 1956. However, when the results were tested for significance by the method of analysis of variance, the difference between the treated and control bins was not significant. The lack of significance was attributed to too short a period of comparison, and it was decided to continue the observations until the treatments ceased to give protection or significant differences were obtained.

The amounts of methoxy-DDT recovered from the wheat in December 1955 were 80, 64 and 45 per cent., respectively, of the amounts applied in the three treatments. In October 1956, 40, 45 and 35 per cent., respectively, remained. The residues on other lots of wheat when received at the mill were less than one-half of the applied amount (13·6 p.p.m.). By the time the wheat had passed through the cleaning and tempering processes, the residues had been reduced to between 1·47 and 2·09 p.p.m. The largest portion occurred in the feed fractions (bran and shorts) with small amounts in the second and first clear flours and less than 0·5 p.p.m. in the patent flour. The baking process did not destroy residues of methoxy-DDT, but it reduced them by 21–44 per cent. There was little change in the over-all moisture content of the wheat, and no changes in its commercial grade tests.

Dusts applied to shelled maize in August 1953 at rates to give deposits of 54 and 108 p.p.m. gave excellent protection through 1954 and 1955, and the differences demonstrated that the dosage levels were greater than needed for effective protection over the 30-month observation period. When dusts were applied in August 1954 at rates to give deposits of 36 and 54 p.p.m., excellent protection was given until February 1956. The differences between the treated lots and the controls were significant and demonstrated that the dosage levels were greater than needed for effective protection over the 19-month observation period.

Dusts applied to other lots of shelled maize in August 1954, in which the concentration of methoxy-DDT was varied but the total amount kept constant at 45 p.p.m., gave uniformly excellent protection against infestation until February 1956. The differences between the treated lots and the controls were not significant, which was attributed to too short a period of comparison, but it was necessary to terminate the tests. When test insects were confined on samples from the treated bins at quarterly intervals, the mortality obtained declined at about the same rate as the amount of residue. Analysis of the residues from 16 points in a bin of shelled maize revealed a high concentration in the centre of the bin beneath the spout of the conveyor. The moisture content of the samples indicated a continual transfer of moisture within the grain mass, but little change in the average

for the bin. There was an effect on the commercial grade of the grain in that 25 of the 43 bins under observation were downgraded from 1 to 5 grades because of increases in the amount of total damage, which were attributed to moisture accumulation in the surface layer. No downgrading was attributed to the dusts.

Stored-grain insects of five genera were found in the wheat, the most abundant being *Cryptolestes* (*Laemophloeus*) spp., probably a complex of *C.* (*L.*) *pusillus* (Schönh.), *C.* (*L.*) *ferrugineus* (Steph.) and *C.* (*L.*) *turcicus* (Grouv.). Far more were found in the maize. The rice weevil [*Calandra oryzae* (L.)] was the most abundant in the bins receiving protective treatments, but it was insignificant in the control bins, a situation that could not be explained.

Bailey (L.) & Lee (D. C.). **The Effect of Infestation with** *Acarapis woodi* **(Rennie) on the Mortality of Honey Bees.**—*J. Insect Path.* **1** no. 1 pp. 15–24, 1 fig., 11 refs. New York, N.Y., 1959.

The following is virtually the authors' summary. Laboratory observations in Britain showed that only old and heavily infested honey bees are killed by *Acarapis woodi* (Rennie); also, of marked bees in colonies, only individuals in the oldest age group died. Whole colonies in the field are rarely destroyed: the few that were had over 30 per cent. of individuals infested, and they died in late winter, when the average age of bees is greatest. Colonies rarely show signs of infestation in summer or autumn. Heavy infestation of bee colonies with *A. woodi* seems most likely after seasons of poor honey yields, or in colonies that have had their development unduly suppressed. Restricted development of brood in summer was associated with increased infestation.

McEwen (F. L.) & Hervey (G. E. R.). **Microbial Control of two Cabbage Insects.**—*J. Insect Path.* **1** no. 1 pp. 86–94, 8 refs. New York, N.Y., 1959.

The following is virtually the authors' summary. Field tests conducted at Geneva, New York, during 1958 indicate that commercially produced spore preparations of *Bacillus thuringiensis* provide good control of *Pieris rapae* (L.) on cruciferous crops when used in a spray at a dosage equivalent to 0·3 lb. per acre of a preparation containing 100,000 million spores per g. This control was superior to that obtained using a suspension of the granulosis virus, *Bergoldia virulenta* [*cf. R.A.E.*, A **45** 263], at the dosages tested. A light infestation by *Trichoplusia ni* (Hb.) was not adequately reduced with the bacillus at 0·3 lb. or with the polyhedrosis virus of this Noctuid.

Frick (K. E.). *Liriomyza dianthi* **n. sp., a new Pest of Carnations in California (Diptera: Agromyzidae).**—*Proc. ent. Soc. Wash.* **60** no. 1 pp. 1–5, 4 figs., 2 refs. Washington, D.C., 1958.

A species of *Liriomyza* that appeared suddenly in 3–4 commercial carnation plantings in Redwood City, California, is described from adults of both sexes as *L. dianthi*, sp.n. The larvae formed large white mines in the leaves,

thus reducing the market value of the cut flowers. Carnations had recently been imported into the San Francisco Bay area from South America, but no Agromyzid is known to mine carnation or related plants there. *L. dianthi* most nearly resembles *L. langei* Frick [*R.A.E.*, A **40** 65], the type locality of which is only 15 miles from Redwood City, and characters differentiating the two are described. Three larvae seen were typical of the genus.

EBELING (W.). **Subtropical Fruit Pests.**—[Revd. edn.] $10\frac{3}{4} \times 7\frac{3}{4}$ in., vi + 436 pp., 8 col. pls., 164 figs., text illus., $15\frac{1}{2}$ pp. refs. [Berkeley, Cal.] Univ. Cal., 1959. Price $7.00.

The subject-matter of this second edition of a work on animal pests of subtropical fruits, of which the first was published under another title [*R.A.E.*, A **38** 265], differs from that of the earlier one in being restricted to general aspects of control and to specific pests. The information resembles that previously given under these categories in general scope, but has been re-arranged, brought up to date and extended to include additional species. The text is in three parts, of which the first contains chapters dealing with the functions of official, commercial and other organisations concerned with pest control in the United States, biological control, artificial control measures, spray oils, fumigants and equipment used in chemical control. The second part deals with pests that attack *Citrus* in the United States and in other parts of the world and contains information on appearance, damage, bionomics and control, with, for each State or country, check lists of the pests occurring there and maps showing the *Citrus*-growing areas. In the third part, one chapter deals in a similar manner with pests of avocado (including a check list of world pests), and others are concerned with pests of grape-vine, walnut, almond, peach, olive, fig, date and fruits of minor importance in the United States, including species that attack the dried fruits.

BEARD (R. L.). **Selection of physiologic Strains of *Oncopeltus* and its Relation to Insecticide Resistance.**—*Bull. Conn. agric. Exp. Sta.* no. 611, 45 pp., 15 figs,. 29 refs. New Haven, Conn., 1957.

The following is based on the author's discussion and summary. Studies on the variations that occur in an insect population and the selecting mechanisms that act on the variable population to result in selection of physiological strains by inheritance were made as a contribution to the understanding of the development of resistance to insecticides in insects, special attention being given to variation in the responses of single individuals on different occasions. This required the use of chemicals that could be applied repeatedly without ill effects, and those selected were carbon dioxide and nitrous oxide, which have the same density and symptomatically similar anaesthetic effects, but differ in action in several important ways. Adults of *Oncopeltus fasciatus* (Dall.) served as the test insects, and the time required for the occurrence of a righting reflex after anaesthesia was the criterion of response.

It was thought that selective breeding based on repeated testing and successive elimination from among the same insects should lead to the segregation of physiological strains more rapidly than selective breeding based on single tests. From sample populations of *O. fasciatus*, individuals were selected for consistently rapid or consistently slow response by repeated

testing, and the range of response in such selected individuals was found to be at a minimum, whereas individuals selected for rapid or slow response on the basis of a single exposure were much less consistent in their performance. The two types of selection were tested in triplicate with each gas, and comparisons were made after ten generations, and in some cases after 15; after ten generations, some lines were continued without further selection to test the fixity of the genetic segregation.

Segregation of true physiological strains showing extreme response times was obtained by all selecting procedures. Strains selected with nitrous oxide were somewhat more extreme than those selected with carbon dioxide, and segregation was only slightly greater with repeated tests than with single exposures. When selection was relaxed, however, the strains selected by repeated treatments retained their segregation, whereas those selected by single treatments reverted to normal; it appears that the latter method permits the dilution of genetic elements responsible for extreme response even though this does not retard the segregation of strains if selection is maintained.

It was shown that carbon dioxide and nitrous oxide produce anaesthesia in different ways; correlation of responses to the two gases varied with individuals, and group responses reflected the proportion responding similarly or dissimilarly, showing a full range from negligible to complete cross-selection among the several lines. This indicates that the course of cross-selection may be determined not by the mode of action of a chemical in a restrictive sense, but by all its toxicological features. Thus, the use of insecticides with different modes of action in the restrictive sense may not prevent the development of cross-resistance, and cross-resistance cannot be depended on as a criterion of similar modes of action.

Selective breeding was also carried out for ten generations with exposure to mixtures of carbon dioxide and nitrous oxide and to each gas alternately, both within generations and between them, to test the view that susceptibilities to differently acting chemicals are probably not correlated and that the use of combinations or alternate applications of different chemicals would retard the concentration of genic combinations responsible for resistance. This theory was not substantiated; susceptibilities to the differently acting gases were not necessarily uncorrelated, and physiological strains of bugs showing rapid and slow response were obtained with all selecting procedures. The alternate use of carbon dioxide and nitrous oxide resulted in somewhat less segregation than the other selecting procedures, but the differences were not great enough to suggest a practical programme of insect control that would forestall the development of resistance. Nothing unusual in the genetics of selection appeared. Crossing tests indicated straightforward inheritance, with no sex linkage, and the responses observed were doubtless due to multiple genic factors.

KHAN (M. A.). *Sphaerularia ungulacauda* **sp. nov. (Nematoda: Allantonematidae) from the Douglas Fir Beetle,** *Dendroctonus pseudotsugae* **Hopk., with Key to** *Sphaerularia* **Species (emended).**—*Canad. J. Zool.* **35** no. 6 pp. 635–639, 5 figs., 8 refs. Ottawa, 1957.

The following is the author's summary. A new species of nematode, *Sphaerularia ungulacauda* (Allantonematidae), is described from the Douglas fir beetle, *Dendroctonus pseudotsugae* Hopk., from British Columbia, Canada. The diagnostic characters of the genus *Sphaerularia* are emended, and a key to species [*cf.* also *R.A.E.*, A **47** 281] is given.

Stephens (J. M.). **Occurrence of *Pseudomonas aeruginosa* (Schroeter) Migula in Haemolymph of Grasshoppers after Infection by Feeding.**—*Canad. J. Microbiol.* **4** no. 3 pp. 191–193, 3 refs. Ottawa, 1958.

When 129 adults of *Melanoplus bivittatus* (Say) were fed on sufficient lettuce contaminated with the bacterium, *Pseudomonas aeruginosa*, to receive a dose of approximately 35–120 times the calculated LD50 [*cf.* *R.A.E.*, A **47** 341], 87 became lethally infected. In most, the numbers of *P. aeruginosa* in the haemolymph were at first small, and in 67 per cent. the bacterium was detected there only 24 hours before death or not at all. Only one of the infected grasshoppers survived, and the others died within 21 days of feeding, over half of them within a week. The disease produces no visible symptoms, and *P. aeruginosa* could not be detected anywhere in the grasshopper within three days of ingestion. The rapidity of infection and the percentage mortality were greatly increased in grasshoppers kept in a limited space with high humidity.

Hueck (H. J.). **The Development of a comparative Method for the Evaluation of the Moth-proofness of Wool Serge.**—*Ann. appl. Biol.* **46** no. 4 pp. 511–528, 4 graphs, 2 refs. London, 1958.

It is sometimes necessary to compare assessments made in laboratories in different countries of the extent to which woollen cloth has been rendered moth-proof by chemical treatments, and, since these are not always in agreement, the adoption of a standard testing method is desirable. Investigations were therefore carried out to provide a basis for recommendations as to a suitable procedure. In this paper, the work is reviewed, a representative sample of the more important data given, and the recommended testing method described. Larvae of *Tineola bisselliella* (Humm.) were used as test insects throughout.

The existing British and Swiss methods are both based on the weight of fabric lost under standard conditions of exposure to the test insect [*cf.* *R.A.E.*, A **47** 302] and differ chiefly in the treatment of the test fabric, which is baited in the Swiss method, and in the use in the assessment of absolute loss of weight in the British and of percentage loss in the Swiss method. When two kinds of woollen cloth (blanket and uniform cloth) impregnated with a commercial preparation of 2,2′-dihydroxy-3,5,3′,5′,5″-pentachlorotriphenylmethane-2″-sodium sulphonate at various concentrations were tested by the two methods in each of seven laboratories, the results were found to lack agreement between laboratories. Several factors that might influence the results were investigated separately, and it was found that accuracy was considerably increased when weight loss due to larval attack on test samples was compared with that on a standard woollen serge impregnated with a standard moth-proofing substance instead of untreated serge. The procedure provisionally recommended consists in exposing each of ten unbaited cloth samples, 4 cm. in diameter, to attack by 15 larvae of *T. bisselliella*, reared in a standard manner, for 14 days at a defined temperature and humidity, together with ten similar samples of standard serge, five treated at one concentration of the standard agent and five at another. Provision for adequate randomisation must be made. The weight loss in the samples, determined as the amount of wool actually eaten by the larvae, is after mathematical treatment transformed into an equivalent amount of the standard moth-proofed cloth, and the concentration of the standard moth-proofing substance corresponding to this is obtained by reference to a straight-line graph drawn from the results given by the two reference concentrations of the standard substance. Dinitro-α-naphthol was provisionally adopted as

the standard substance, a concentration of 0·8 per cent. of this as the tolerance level and 0·4 and 1·2 per cent. as the reference concentrations. The method is intended for the determination of the acceptability of moth-proofed samples and is unlikely to be of value in routine testing of moth-proofed fabrics.

Bevan (W. J.) & Uncles (J. J.). **Studies on Soil Population of *Contarinia pisi* Winn. in 1957 in Yorkshire and Lancashire.**—*Ann. appl. Biol.* **46** no. 4 pp. 529–535, 5 graphs, 4 refs. London, 1958.

The following is largely the authors' summary. Infestation of peas by *Contarinia pisi* (Winn.) was heavy in northern England in 1955 and 1956, and a new method of handling the large amounts of floating material obtained by washing soil through the wet-extraction apparatus already described [*cf. R.A.E.*, A **41** 4, etc.] was devised for studies of the numbers of cocoons, larvae and pupae in the soil. The liquid containing the insect material was made to spill over from the flotation tank into a chute 6 ft. in length, 4 in. in diameter, and blocked at the far end by a movable plasticine wall that enables the liquid in it to be maintained at a suitable level. The insect material was removed by three people working side by side, and the débris was collected in a fine-meshed sieve after leaving the chute and floated through the apparatus a second time.

Examination of soil samples in the summer of 1957 from fields that carried heavily attacked pea crops in 1956 indicated that pupae were present at depths of 0–9 in. from 18th June onwards, and that the peak of adult emergence was in the period between 28th June and 2nd July; observations on adult activity in pea fields confirmed this. Small numbers of pupae were recovered throughout July. Similar studies on pea fields in 1957 illustrated the increase in cocoon numbers and the rate of pupation of the larvae. The first flight of 1957 was composed of individuals from the 1956 generation and was far larger than the second flight, which was composed of some of the 1956 generation and part of the first generation of 1957. There were indications that increases of temperature might accelerate pupation, with a resulting earlier emergence of adults. The size of the populations recorded from soil from fields under green-pea and dry-harvesting pea crops tended to be similar and appeared to be related to sowing date; in general, they were considerably larger for crops sown between the fourth week of April and the second week of May than for those sown earlier or later.

Coaker (T. H.). **Experiments with a Virus Disease of the Cotton Bollworm *Heliothis armigera* (Hbn.).**—*Ann. appl. Biol.* **46** no. 4 pp. 536–541, 16 refs. London, 1958.

The following is based partly on the author's summary. Laboratory tests with a nuclear polyhedral virus disease of *Heliothis armigera* (Hb.) in Uganda [*cf. R.A.E.*, A **46** 198, 455] indicated that it was more infective and had a shorter incubation period in the younger than in the older larvae. Larvae on cotton plants sprayed with an aqueous suspension of the virus became infected. Mortality depended on the number of polyhedra applied to the plant, irrespective of the concentration in the suspension, and was highest (83·3 per cent.) when the number applied was 2,000 million. Sprays containing the virus were not effective when applied in the field in Uganda, but might give control in places where it is not already endemic and where numbers of *H. armigera* fluctuate more widely during the year.

It is stated in an addendum that a similar virus that infects *H. zea* (Boddie) and *H. virescens* (F.) in the United States and a polyhedral virus

extracted from *Argyrostagma niobe* (Weym.) from Kenya both caused infection in *H. armigera* in Uganda, but it was not known whether the latter was direct or the result of activation of latent virus [*cf.* **46** 386, etc.].

Slykhuis (J. T.) & Watson (M. A.). **Striate Mosaic of Cereals in Europe and its Transmission by** *Delphacodes pellucida* **(Fab.).**—*Ann. appl. Biol.* **46** no. 4 pp. 542–553, 1 pl., 13 refs. London, 1958.

The following is based partly on the authors' summary. A virus disease that resembles wheat striate mosaic [*cf. R.A.E.*, A **43** 271] was found affecting up to 5 per cent. of the plants in wheat fields in England in 1956. The symptoms included fine chlorotic striae, followed by stunting, general chlorosis, and death of plants. Other hosts included oats, barley, rye, perennial rye grass (*Lolium perenne*) and Italian rye grass (*L. multiflorum*). The virus was transmitted only by *Delphacodes pellucida* (F.) in experiments in which leafhoppers of various species collected on grass near wheat fields were confined for a week on diseased plants and then for another week on wheat seedlings. *D. pellucida* was found on most lawns, pastures and roadsides examined in 1956, but was nowhere abundant. A few examples were already infective when caught in the field. The percentage of infective individuals was increased by feeding the insects for 24 hours or longer on diseased plants, and up to 56 per cent. became infective after feeding on diseased plants for three days. Previously non-infective insects were unable to transmit the virus until 8–36 days after they had first fed on diseased plants, but they frequently remained infective for the remainder of their lives, up to ten weeks after feeding on a diseased plant. Infective insects seldom transmitted the virus during test feeds as short as 30 minutes. When fed for one or more days on each test plant, some insects infected many plants in succession, others seldom infected test plants even if they fed for as long as seven days on each. The virus was transmitted through the eggs to as many as 88 per cent. of the progeny of infective females, and to some of the progeny of a few females that had failed to infect wheat test plants.

Symptoms characteristic of the same disease were observed on wheat and rye in Denmark and on wheat in Germany in May 1957, and the virus was transmitted from a wheat plant brought from Spain. Similar diseases of cereals occur in the Soviet Union [**29** 13; **30** 581], and *D. pellucida* is associated with severe damage to oats in Finland, though it is not known whether the virus is involved in that country [*cf.* **46** 405].

Badami (R. S.). **Changes in the Transmissibility by Aphids of a Strain of Cucumber Mosaic Virus.**—*Ann. appl. Biol.* **46** no. 4 pp. 554–562, 21 refs. London, 1958.

The following is substantially the author's summary. A strain of cucumber mosaic virus isolated from a spinach plant in England in 1946 was readily transmitted by *Myzus persicae* (Sulz.) until 1955 when it lost this property, although it was still being propagated in conditions in which other strains remained transmissible. Also, *M. circumflexus* (Buckt.) was able to transmit other strains but not the spinach strain, which, however, was transmitted as readily as the other strains by *Aphis gossypii* Glov. and, to a less extent, *M. ascalonicus* Doncaster. Transmission of the spinach strain by other aphids did not make it transmissible by *M. persicae*, nor did propagation in different plant species or several passages through spinach. In 1955, the spinach strain was occasionally transmitted by *M. persicae*, but the cultures isolated in this way were no more readily transmissible by the aphid than

was the bulk culture maintained by manual inoculation of sap, and after a few weeks all cultures ceased to be transmitted by *M. persicae*.

Tarr (S. A. J.). **Experiments in the Sudan Gezira on Control of Wilt of Dolichos Bean (*Dolichos lablab*) associated with Attack by Cockchafer Grubs (*Schizonycha* sp.).**—*Ann. appl. Biol.* **46** no. 4 pp. 630–638, 8 refs. London, 1958.

The following is almost entirely the author's summary. Wilting of dolichos bean (*Dolichos lablab*) has been common in the Sudan Gezira of recent years, and investigations showed it to be due primarily to larvae of *Schizonycha* sp. attacking the hypocotyls or roots of plants up to about six weeks after sowing. Many wilted plants also showed symptoms of ashy stem blight, caused by the fungus, *Macrophomina phaseoli*, which, however, was probably a secondary invader rotting roots weakened or damaged by unfavourable soil conditions or insects. Wilt was often severe in plants sown on land that had been under sorghum in the preceding season, sorghum roots in the soil harbouring the larvae. Under conditions of moderate larval attack, seed dressings containing an organic mercurial fungicide and γ BHC gave satisfactory protection at 0·089 part γ BHC per 100 parts seed, but they were inadequate when wilting was severe. Dieldrin and aldrin at 0·044 or 0·089 part gave excellent protection in all experiments, but their performance under exceptionally severe conditions of wilting has yet to be tested, as also the relative efficiencies of seed treatment and soil treatment under such conditions. Fungicide-insecticide seed treatment also reduced pre-emergence rotting of germinating seeds due to larval attack.

Wilting rarely occurred in plants sown on land fallow in the preceding season, but, even in the apparent absence of wilt, seed treatment often appreciably improved emergence, plant populations, growth and yields. These effects possibly resulted from control of root damage by soil insects, which reduces growth and yields, but is not sufficiently severe to cause wilting. Pending further investigation, a dry seed dressing containing an organic mercurial fungicide with 20 per cent. dieldrin and applied at 1 : 450 by weight to seed (about 5–6 g. dieldrin per acre) is recommended.

Kamel (A. A. M.), Shoeb (A.), Hanna (A.) & Soliman (S.). **Studies of the Effects of some new Insecticides on the Cotton Leaf Worm and Bollworms.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 1–23, 4 graphs, 1 ref. Cairo, 1958.

In plot tests of various insecticides, alone and in combination, in emulsion sprays for the control of pests of cotton, carried out in Egypt in 1957, the numbers of *Platyedra gossypiella* (Saund.) and *Earias insulana* (Boisd.) were reduced by over 72 per cent. by five fortnightly applications between July and early September of Gusathion [O,O-dimethyl S-(4-oxo-benzotriazinc-3-methyl) phosphorodithioate] at 10·2 oz. active ingredient per acre in combination with DDT at 17 oz. or endrin at 5·3 oz. per acre, and yields of 1,687 and 1,736 lb. seed cotton per acre were obtained, as compared with 1,128 lb. per acre from untreated plots. Endrin alone at 10·5 oz. per acre and mixtures of endrin or DDT with Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] and of endrin with DDT reduced numbers by 33–60 per cent. A reduction of nearly 74 per cent. was obtained in a second group of tests with five applications of a mixture of Gusathion and toxaphene giving 10·2 and 45·3 oz. active ingredient per acre, respectively; other combinations of Gusathion, Dipterex, toxaphene, DDT and endrin were not so effective. *Prodenia litura* (F.) was controlled by all the materials used. In tests on a

larger scale carried out at the same time, in which four applications were made at intervals of 15 days from 10th July, yields were generally correlated with bollworm populations. A maximum yield of 3,006 lb. of seed cotton per acre was obtained from plots that had been sprayed with the mixture of Gusathion and endrin, as compared with 2,860, 2,841, 2,189, 2,167 and 1,606 lb. per acre after the use of Gusathion and DDT, endrin and DDT, Dipterex and endrin, Dipterex and DDT, and toxaphene, respectively.

Kamel (A. A. M.) & Shoeb (A.). **The chemical Control of the Greasy Cut-worm.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 24–39, 1 fig. Cairo, 1958.

Four series of tests were carried out in Egypt in 1957 to assess the value of various insecticides in baits, sprays and seed dressings as substitutes for paris-green bait in the control of *Agrotis ypsilon* (Hfn.) attacking cotton seedlings. In the tests with poison baits, in which the toxicants were added to baits of bran, molasses and water, the mortality percentages after a week were 56·8 for paris green at about 2·75 lb. per acre, and among materials more effective than this, 80·2 and 67·4 for dieldrin at 17·1 and 12·7 oz., 77·6 and 66·2 for toxaphene at 61·1 and 48·9 oz., 76·7 for a liquid concentrate containing 30 per cent. DDT and 9 per cent. γ BHC used at a rate of 21·2 oz. DDT per acre, 59·8 for a dust containing 10 per cent. DDT and 3 per cent. γ BHC at 10·2 oz. DDT per acre, and 58·2 for sodium fluosilicate at 136 oz. per acre. In tests of emulsion sprays applied on 18th April, dieldrin, toxaphene and endrin at 13·5, 70·8 and 10 oz. per acre, and the concentrate of DDT with γ BHC at 21·2 oz. DDT per acre, gave kills of 79, 77·9, 76 and 69·8 per cent. one week after application. The same sprays applied on 31st March as protective treatments to 10-day-old seedlings in fields with heavy weed growth proved satisfactory for about two weeks, and dieldrin and endrin reduced larval populations by 100 and 98·4 per cent., respectively, after four weeks. In the tests of seed treatments, dressing the seed with Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] or Disyston [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] at rates affording 68–102 and 147–185 oz. toxicant per acre, respectively, gave protection for about five weeks, but the natural infestation was too low for final recommendations to be made.

Mettwally (A. G.). **Significance of Time of first Application of Insecticides and Number of Applications in Control of Cotton Bollworms.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 40–45, 1 graph. Cairo, 1958.

Plot tests in Egypt in 1957 showed that spraying cotton with toxaphene against *Platyedra gossypiella* (Saund.) and *Earias insulana* (Boisd.) was most successful when four applications were made at intervals of 14–19 days, beginning in mid-July, when field populations of the bollworms were still low. Yields of seed cotton after 2, 3, 4 and 4 applications, with the first made on 22nd and 5th August and 24th and 17th July, respectively, were 1,608, 1,851, 1,972 and 2,093 lb. per acre, as compared with 1,274 lb. per acre from untreated plots.

Madkour (A.) & Lotfy (M. S.). **A Note on preliminary Experiments dealing with the Control of dormant Pink Bollworms in Cotton Bolls by Fumigation under Tents.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 46–50, 1 fig. Cairo, 1958.

Since resting larvae of the pink bollworm [*Platyedra gossypiella* (Saund.)]

in cotton bolls remaining on the plants after harvest are the main source of infestation of the succeeding crop in Egypt, tests were carried out in 1954–55 to assess the value of fumigation with hydrogen cyanide for their control. Fumigation was effected by covering infested stalks with a tent of rubber or cotton fabric coated with polyvinyl chloride and enclosing a bottle fitted with a dispensing device that enabled sodium cyanide to be dropped into dilute sulphuric acid by operation from outside the tent. From 18 experiments with various concentrations of HCN, in which both types of tent gave comparable results, it was ascertained that 92·4–100 per cent. control was given by using 35 oz. sodium cyanide with 35 fl. oz. acid and 70 fl. oz. water per 1,000 cu. ft. with a fumigation period of 24 hours, or 50 oz. with 50 oz. acid and 100 oz. water for 12 hours. In similar tests, Cyanogas calcium cyanide at a rate of 70 oz. per 1,000 cu. ft. gave only 60·8–74·3 per cent. control after fumigation for 24 hours.

Samy (O.). **Green Cotton Boll Shedding in Relation to Insect Infestation of Flowers.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 51–58, 1 graph, 4 refs. Cairo, 1958.

The following is based mainly on the author's summary. The effects of infestation of the buds of cotton on boll shedding were studied in Egypt in 1942–46. About 30 per cent. of over 29,000 flowers examined had been attacked by insects, 25·5 per cent. by *Creontiades pallidus* (Ramb.), 3·6 per cent. by *Platyedra gossypiella* (Saund.), 0·6 per cent. by *Prodenia litura* (F.) and 0·1 per cent. by *Earias insulana* (Boisd.). Some 22 per cent. of the bolls were subsequently shed when there was no insect infestation and nearly 30 per cent. when the buds had been attacked, but the percentages varied widely, differing with the insect concerned. Although *Earias* and *Platyedra* infested few buds, they increased shedding by 19·52 per cent., whereas the commonest insect present (*C. pallidus*) caused an increase of only 5·52 per cent. Individual percentages of bolls shed owing to attack by *C. pallidus*, *Prodenia*, *Platyedra* and *Earias* were 27·77, 30·69, 43·28 and 50, respectively.

Kassab (A.), Bahaa el Dine (S.) & Shahwan (A. A. M.). **The Effect of some synthetic Compounds on the Mole-cricket in comparison with Zinc Phosphide.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 59–72, 2 graphs, 15 refs. Cairo, 1958.

Injury to the roots of vegetables and other crops by *Gryllotalpa gryllotalpa* var. *cophta* (de Haan) has increased in recent years in Lower Egypt, owing to the expansion in production and the increased use of organic manures. Damage to root vegetables often approaches 16·8 per cent., and laboratory and field experiments were carried out to compare the effectiveness of some of the newer insecticides, which might also control other soil pests, with that of the zinc-phosphide baits so far used.

In bait tests in the laboratory, in which moistened, crushed maize with 5 per cent. added insecticide was spread on soil in cages at a rate equivalent to 25·5 lb. per acre, chlordane and parathion (E 605) gave 96·7 per cent. kill in seven days, BHC (containing 2·6 per cent. γ isomer), a weaker preparation of parathion and zinc phosphide gave 93·3 per cent. kill, and toxaphene gave 90 per cent. kill. A liquid preparation of parathion in which the seed was dipped was less effective, and DDT gave poor results and was not further tested. Similar results were obtained in tests with the other insecticides applied as dusts at a concentration of 20 per cent. in rock phosphate. The

combined results showed that the highest kills were given after 1–2 days by parathion and zinc phosphide, after 2–3 days by chlordane and BHC, and after 3–4 days by toxaphene; death usually occurred after 20, 22, 35, 40 and 48 hours with parathion, zinc phosphide, BHC, chlordane and toxaphene, respectively.

The same insecticides applied as baits and dusts in plot experiments on a variety of soils in infested areas at rates of 25·5 and 33 lb. per acre, respectively, were about as effective as zinc phosphide in baits. BHC was considered the best alternative for zinc phosphide on the basis of cost and harmlessness in use, and pot and field experiments were instituted to determine its effect on a wide range of vegetables. At the rate used for control of *G. gryllotalpa*, no adverse effects on plant growth were noted and the only crop tainted was spinach.

Isa (A. L.). **On the chemical Control of Corn Borers.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 73–78, 1 graph, 2 refs. Cairo, 1958.

Maize in the north of the Nile delta is attacked by *Sesamia cretica* (Led.), *Chilo suppressalis* (Wlk.) (*simplex* (Btlr.)) and *Pyrausta nubilalis* (Hb.), which together cause an annual crop loss of 7 per cent. Larvae of *S. cretica* bore into the unopened leaves when the plants are about 1 ft. high, immediately after hatching, whereas eggs of the other two species are laid on the leaves of plants about 3 ft. high and the larvae wander on the leaf surface before entering the plant. As ryania, cryolite and DDT proved the best of several insecticides tested against the borers in preliminary work, these three were further tested singly and in combination as sprays in plot experiments near Alexandria. Four applications were made, when the plants were about 20, 30, 45 and 60 days old (1, 2 and 3·5 ft. high and in the ear stage, respectively), at a rate of about 31 gal. per acre in the first two applications and at 53 gal. per acre in the last two. The best control (91·4 per cent.) was given by 50 per cent. DDT wettable powder at 10 lb. per 100 gal.; 85·4 per cent. control was given by 5 lb. wettable DDT with 5 lb. ryania, 84·9 per cent. by 5 lb. wettable DDT with 1 lb. cryolite, and 73·9 per cent. by 5 lb. ryania with 1 lb. cryolite per 100 gal. DDT alone or with cryolite gave over 90 per cent. reduction in ear infestation, and the over-all yield increases were 145·4, 136·3, 130·3 and 112·1 per cent. for DDT, DDT with cryolite, ryania with cryolite and DDT with ryania, respectively.

Hassan (M. S.). **Testing Phosphorous Compounds and Chlorinated Hydrocarbons against Aphids.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 79–93. Cairo, 1958.

Numerous tests were carried out in Egypt in 1948–57 on the effectiveness of synthetic organic insecticides, usually in proprietary formulations, against aphids on a wide variety of plants. The results are given in tables, and the following is based on the author's conclusions from the work. Phosphorus compounds, including parathion, Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)], Metasystox [dimethyl 2-(ethylthio)ethyl phosphorothioate (methyl-demeton)], malathion, Gusathion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] and Ekatin [O,O-dimethyl S-2-(ethylthio)ethyl phosphorodithioate] gave very good results in sprays, but demeton and methyl-demeton were not translocated from banana plants to their off-shoots in sufficient amounts to kill *Pentalonia nigronervosa*

Coquerel. BHC dusts were effective against *Aphis gossypii* Glov. on cotton at high concentrations, but scorched the leaves and lost their efficacy in a short time. Nicotine sulphate was in general less effective than any of these compounds, but is preferred to them on account of its safeness in use.

Kamel (A. H.). **The Effect of Pyrenone Grain Protectant on the Protection of Stored Grains against Stored Grain Insects.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 96–109, 6 refs. Cairo, 1958.

In laboratory tests in Egypt, wheat was treated with 0·1 per cent. of its weight of Pyrenone Grain Protectant (P.G.P.), a proprietary powder containing 0·05 per cent. pyrethrins and 0·8 per cent. piperonyl butoxide, and adults of *Calandra* (*Sitophilus*) *oryzae* (L.) and *Rhizopertha dominica* (F.) confined with it at an average temperature of 23·5°C. [74·3°F.]; mortality was complete in nine days. *Tribolium castaneum* (Hbst.) was more resistant; complete mortality at 23·5°C. [74·3°F.] resulted 27 and 16 days after treatment with P.G.P. at doses of 0·1 and 0·2 per cent., respectively, and at an average temperature of 19°C. [66·2°F.], 0·5 per cent. P.G.P. caused only 72 per cent. mortality after 30–43 days. The exposure of P.G.P. to sunlight for up to 39 weeks had no significant effect on its toxicity to *T. castaneum*, but material that had been stored under normal conditions in a paper bag for four years lost its activity. Germination of the seeds of several cereals was not impaired by treatment with P.G.P., even when it was used at an excessive rate.

In a large-scale test, P.G.P. mixed with lightly infested wheat at 0·2 per cent. permitted 15·8 per cent. infestation after eight months, as compared with 6·6 per cent. for Katelsousse (a 5:1 mixture of rock phosphate and sulphur) at 1 per cent. and 11·6 per cent. for rock phosphate alone at 1 per cent. Better results were obtained when the wheat was initially uninfested, the infestation rates being 2·3, 0·06 and 1·7 per cent. for P.G.P., Katelsousse and rock phosphate, respectively, at the same rates as before, 12 months after treatment and 8 months after artificial infestation of the grain. The three materials gave comparable results (0–2 per cent. infestation) in tests with wheat in bins, sacks or heaps, but 20·4–25·6 per cent. of the grain at the base of heaps became infested regardless of the protectant used.

Koura (A.). **A new Transparency Method for detecting internal Infestations of Grains.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 110–113, 8 refs. Cairo, 1958.

The following is virtually the author's summary. A new transparency method for observing and detecting internal infestation in wheat grains is presented. It involves soaking the grains in a solution containing two parts each of distilled water, lactic acid and phenol and one part glycerine at the rate of 20 g. of the liquid to 1,000 grains of wheat for 2–4 hours. The method has proved satisfactory in observing or detecting larvae, pupae and adults and holes and tunnels made by hatching larvae. Adults could further be identified under certain conditions. The method is rapid, does not require special apparatus and was applicable to other seeds.

Hosny (A.) & Samak (M. M.). **Studies on the Effect of some new Insecticides on *Polychrosis botrana* Schiff. (Lepidoptera-Tortricidae) in Egypt.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 114–118. Cairo, 1958.

Lobesia (*Polychrosis*) *botrana* (Schiff.) is responsible for 30–75 per cent.

damage to grapes in the north of the Nile delta. In field tests on control carried out in 1955, in which five applications were made at intervals of three weeks, beginning on 19th April, sprays containing parathion and DDT were the most effective. DDT with γ BHC, and also toxaphene and Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate], were of rather lesser value, and diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] was the least effective. The kill varied slightly according to which of two varieties of grape was treated, but vines of both varieties produced larger grapes when treated than when untreated.

Ezzat (M. A.). **A short Note on the chemical Control of the Mediterranean Fruit Fly** *Ceratitis capitata* (**Wied.**) **Diptera: Trypetidae.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 p. 119. Cairo, 1958.

A spray of 2·5 lb. 25 per cent. wettable γ BHC, 0·5 gal. molasses and 1 lb. flour per 100 gal. water, applied 4–5 times at 10-day intervals from the time that fruit became susceptible to attack by *Ceratitis capitata* (Wied.), reduced infestation of peaches in Egypt in 1954 from 98 to 1 per cent. and of pears in 1955 from 87 to 0·2 per cent.

Atalla (E. A. R.). **Studies on the Ecology and Control of the Olive Fruit-fly** *Dacus oleae* **(Gmel.) in Egypt (Diptera-Trypetidae).**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 120–137, 9 figs., 2 refs. Cairo, 1958.

Dacus oleae (Gmel.) causes a loss of 30 per cent. of the olive crop in Egypt. The Trypetid is widely distributed, but is commonest on the coastal edge of the western desert, in Siwa oasis, and in the provinces of Giza, Faiyum and Beni-Suef. From counts of flies taken in invaginated glass traps baited with ammonium phosphate and an aqueous extract of bran in 1953–56 at Bourg el-Arab in the western desert, it was found that there were about four generations a year, with maximum and minimum populations in November and May, respectively. More males than females were taken in July–November, but the ratio was reversed during the remainder of the year. Infestation of olives was correlated with the population changes, beginning in June and rising to a peak of 74·6 per cent. in November. On individual varieties, it ranged from 100 per cent. on those having large, fleshy fruits to only 30 per cent. on the one with the smallest fruits.

Field experiments were conducted in 1954–56 at three sites with a spray containing 0·625 lb. wettable γ BHC, 1 lb. flour and 0·5 gal. molasses per 100 gal. water. Trees were sprayed 6–7 times at 10-day intervals from about 35–40 days after fruit-set until harvest. The percentage of uninfested fruits was 94–100, as compared with 0–2 on untreated trees.

Attiah (H. H.). **Preliminary Experiments on the Control of the Two Spotted Spider Mite on Cotton.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 138–149, 4 figs. Cairo, 1958.

Field experiments were carried out in Egypt in 1956–57 to find a more effective treatment than dusting with sulphur for the control of a mite of the complex *Tetranychus telarius* (L.) on cotton. In the first series, sprays were applied on 6th August at about 160 gal. per acre and compared with sulphur dust at 63 lb. per acre. Complete mortality of the mites was given within four days by materials containing 20 per cent. Ekatin [O,O-dimethyl S-2-(ethylthio)ethyl phosphorodithioate] or 25 per cent. Hercules 528 [2,3-p-

dioxane S,S-bis(O,O-diethyl phosphorodithioate)], each at 16 fl. oz. per 100 gal. water, and by 8 per cent. Tedion [2,4,5,4′-tetrachlorodiphenyl sulphone] in miscible oil at 2 pints per 100 gal.; 60 per cent. toxaphene at 4 pints and 15 per cent. wettable Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] at 2 lb. per 100 gal. were almost as effective, but 25 per cent. chlorobenzilate [ethyl 4,4′-dichlorobenzilate] at 16 fl. oz. per 100 gal. and Volck oil at 10½ gal. per 100 gal. were not so effective, although better than the sulphur dust. All the materials except chlorobenzilate caused transient symptoms of phytotoxicity. In the second series, low-volume sprays were applied on 19th August. The preparations of Tedion and Hercules 528 and one containing 50 per cent. Metasystox [dimethyl 2-(ethylthio)ethyl phosphorothioate (methyl-demeton)], at rates of 4·7, 1·2 and 1·2 pints per acre, respectively, gave the best control, but the Ekatin and Tedion preparations at 1·2 and 3·2 pints per acre were only slightly less effective, and markedly superior to two applications of sulphur dust at 53 lb. per acre. In the third series, Tedion and Hercules 528 again gave good kills as high-volume sprays, as also did 50 per cent. Metaisosystox [O,O-dimethyl S-2-(ethylthio)ethyl phosphorothioate (methyl-demeton-S)] at 1 lb. in 29 gal. spray per acre; Ekatin was effective as a low-volume spray, and good control was also given by high- and low-volume sulphur sprays. In the final series of experiments, mixtures of 10 gal. 8 per cent. Tedion with 24 gal. 60 per cent. toxaphene and of 17⅗ lb. micronised sulphur with 24 pints 60 per cent. toxaphene per 100 gal., applied at 25 gal. per acre, gave 95·8 and 92·2 per cent. control, respectively, within seven days. Mixtures of toxaphene with Hercules 528 or with methyl-demeton-S proved less satisfactory.

Nour (H.) & Sidarous (F.). **The Effectiveness of certain Insecticides on Lyctid Powder-post Beetles with special Reference to** *Trogoxylon impressus* **Comolli, Family Lyctidae-Coleoptera.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 150–154, 1 graph. Cairo, 1958.

Trogoxylon impressum (Comolli) is injurious to wooden floors and furniture in Egypt, and two series of experiments on its control were carried out in 1956. In the first, samples of oak floor boards measuring 4 × 1 × 1·5 in. were dipped for three minutes in kerosene solutions of insecticides in May and exposed to 20 adults of the Lyctid seven days later in glass jars. Complete kill was given by all the materials tested, the intervals required being three days for both 5 per cent. DDT and 0·5 per cent. γ BHC, four days for 0·5 per cent. dieldrin, eight days for 2 per cent. pentachlorophenol, 18 days for 5 per cent. toxaphene, 20 days for both 5 per cent. creosote and 25 per cent. p-dichlorobenzene, and 22 days for kerosene alone. All the beetles were dead in 31 days on untreated wood. In the second series, oak samples infested by larvae of *T. impressum* were dipped for three minutes in the same materials in January. No adults emerged from the treated boards between February and May, and no living larvae were found in boards that were then split open, as compared with 68 emergences and two dead and six living larvae in untreated boards.

Abou el Fadl (M.), Fahmy (M.) & Hafez (M.). **A Study on the Control of the Pink Bollworm,** *Pectinophora gossypiella* **Saund. through composting the infested Bolls into organic Manure.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 2 pp. 351–356. Cairo, 1958.

As the compulsory burning of cotton bolls infested by *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) in Egypt results in an important loss of natural

fertiliser, experiments were carried out at Giza in 1954–55 to investigate the possibility of composting infested material. A mixture of ammonium sulphate and calcium superphosphate, to provide, respectively, 11 lb. nitrogen and 1¾ lb. phosphorous acid, was added with 143 lb. of soil to each ton of infested bolls. The material was piled in heaps each covering about 6 sq. yd., and the heaps were watered every five days for the first month and occasionally thereafter and turned after 6, 9 and 11 weeks. The mean temperature in the centre of the heaps reached a maximum of 60·6–65·5°C. [141·08–149·9°F.] in 3–7 weeks. The rise in temperature killed all larvae of *P. gossypiella* in the centre of a heap within two weeks, and no living larvae were found in the peripheral regions of the heaps after 11 weeks, when the compost was almost ready for use. The numbers of living larvae found in the peripheral region during the first six weeks were higher than the original infestation rate in one experiment; this was probably caused by movement from the interior of the heap, and it is suggested that the chances of reinfestation would be reduced by siting heaps at some distance from cotton fields and by applying an insecticide round each one. The compost exceeded farm-yard manure in its content of organic matter and total nitrogen.

Amaro (J. P. P.). **Meios de luta contra** "*Pachymerus acaciae*" **Gyll. Ensaios com pos insecticidas . . . Means of Struggle against** "*Pachymerus acaciae*" **Gyll. Experiments with Insecticide Powders.**—*Comun. Conf. int. Africanistas ocident., S. Tomé 1956* **4** pp. 23–34, 2 graphs, 12 refs. [London] Sci. Coun. Afr. S. Sahara [1958]. (With Summaries in Spanish, French & English.)

The following is based almost entirely on the author's summary of this account of experiments on the effectiveness of various insecticides against the eggs of *Caryedon gonagra* (F.) (*Pachymerus acaciae*, auct.) [*cf. R.A.E.*, A **46** 114] on stored groundnuts in Portuguese Guinea. The materials tested were DDT, γ BHC as lindane, and mixtures of pyrethrins with piperonyl butoxide, but only γ BHC was effective. It was used in dusts at concentrations of 0·1, 0·75, 1 and 1·5 per cent. and was mixed with groundnuts at rates of 1·5, 5, 10 and 15 parts per million. It was found that concentration had no influence on mortality, which was determined solely by the rate at which the active ingredient was applied. On the basis of toxicity and on economic grounds, treatment with a dust containing 1 or 1·5 per cent. γ BHC to give a dosage of 15 p.p.m., which in tests gave 97–99 per cent. egg mortality, is considered the most satisfactory.

Castel-Branco (A. J. F.). **A cochonilha dos coqueiros na Ilha do Príncipe (*Aspidiotus destructor* Sign.).** [A Coccid attacking Coconut on the Island of Principe (*A. destructor*).]—*Garcia de Orta* **4** no. 2 pp. 225–238, 1 pl., 1 ref. Lisbon, 1956. (With a Summary in French.) **Ensaio de luta biologica contra a conchonilha do coqueiro na Ilha do Príncipe . . . Biological Control of the Cocopalm Tree Scales on the Island of Principe.** (Abstract in Portuguese, Spanish, French & English.)—*Comun. Conf. int. Africanistas ocident., S. Tomé 1956* **4** pp. 77–78. [London] Sci. Coun. Afr. S. Sahara [1958].

In the first paper, of which the second is a summary in various languages, an account is given of investigations on *Aspidiotus destructor* Sign. on coconut in the Island of Principe, where a heavy infestation was discovered in 1954, and on its control, carried out in August–October 1955. The Coccid was also found infesting other plants, including oil palm (*Elaeis guineënsis*), banana and cacao. Intensity of infestation on coconut was not influenced by

the aspect or situation of the trees, but was heavier on the north-east and north coasts than on the south and west. Populations varied from 58 to 90 females per sq. cm. of leaf surface, and the Coccid was most numerous on the middle portions of the leaves. On infested trees, the leaves turn yellow and wilt, fruits fail to develop, and the crown is ultimately destroyed. Natural enemies observed included two Coccinellids, which were of little importance, *Aspidiotiphagus citrinus* (Craw), *Casca parvipennis* Gah., and other Hymenoptera, which together gave variable but sometimes high control, and a fungus of the genus *Sphaerostilbe*, which destroyed 12·7 per cent. of the adults.

Since control by means of insecticides appeared undesirable or impracticable, *Cryptognatha nodiceps* Mshl., which gave good control of the Coccid in Fiji [*cf. R.A.E.*, A **23** 280], was introduced. Three consignments of Coccinellids, comprising seven species in addition to *C. nodiceps*, were received by air from Trinidad in August–September, but owing to the long journey (six days), during which no food could be supplied, and the high altitude at which the aircraft travelled, mortality was high and of the 3,330 dispatched only 1,081, including 966 of *C. nodiceps*, arrived alive. Of the adults of *C. nodiceps*, some were used as breeding stock and the rest were liberated at various places. Several rearing methods were adopted, but the use as rearing containers of fabric bags containing banana leaves infested with *A. destructor* [*cf.* **18** 10] or of cages about 3 ft. cube containing infested leaves of *Sida rhombifolia*, which were kept under conditions of constant temperature and humidity so that the Coccinellids could gradually become acclimatised, was not very effective, and the best results were obtained in an insectary made by enclosing a coconut tree, not more than about 20 ft. high, in a cage of thin cotton material on a bamboo frame, within which the temperature and relative humidity were 27°C. [80·6°F.] and 85 per cent., respectively. In this, over 4,000 individuals were reared from 40 pairs of *C. nodiceps* in 23 days. At the liberation sites, populations increased to only a limited extent, which is attributed in part to the relatively large areas over which releases were made. In subsequent liberations of the laboratory-reared stocks, groups of 40–50 individuals were released in the pupal stage at places not more than 1 km. apart. The pupae were protected from weather and predators in tubes made from pieces of bamboo that were fixed to the crowns of the trees, and 3,872 were released between 29th September and 27th October. Populations increased rapidly, and the results appeared promising. In June 1956, the author was informed that the trees were recovering, the young leaves being green in colour and the young coconuts developing normally.

Cancela da Fonseca (J. P.). **Aspectos fitossanitários do amendoim (mancarra) armazenado, na Guiné Portuguesa. I. Cercos e armazéns.** [Phytosanitary Aspects of Groundnuts stored in Portuguese Guinea. I. Mounds and Stores.]—*An. Jta Miss. geogr.* **11** pt. 2 pp. 53–82, 17 refs. Lisbon, 1956. (With a Summary in French.) Also in *Comun. Conf. int. Africanistas ocident., S. Tomé 1956* **4** pp. 119–136, 17 refs. [London] Sci. Coun. Afr. S. Sahara [1958]. (With Summaries in Spanish, French & English.)

The author lists the insects found associated with groundnuts stored out of doors in unprotected mounds and in various types of containers and stores in Portuguese Guinea during a survey in March–April 1953 and discusses their occurrence and relative abundance in relation to the situation in which they occur and the physical conditions of the environment, with special reference to species of economic importance. Groundnuts in mounds

at government granaries, where the maximum storage period was 2–3 months, were free from infestation. The Lygaeids, *Aphanus apicalis* (Dall.), *A. sordidus* (F.), *Dicuches armipes* (F.) and *D. patruelis* (Stål), were very abundant at the base and on shaded sides of mounds at three of five trading centres visited. Mounds at two trading centres were infested by *Corcyra cephalonica* (Stnt.) and *Ephestia cautella* (Wlk.), and *C. cephalonica*, in particular, was very abundant beneath the surface layers in one of them. Other insects found included *Tribolium castaneum* (Hbst.), *T. confusum* Duv. and *Caryedon gonagra* (F.) (*Pachymerus acaciae*, auct.) [*cf. R.A.E.*, A **46** 114]. In mounds at a river port, Heteroptera, especially *A. sordidus*, were numerous and *C. gonagra*, *Dermestes ater* Deg., *Tenebroides mauritanicus* (L.), *Oryzaephilus mercator* (Fauv.) and *Tribolium confusum* also present at the shaded sides and base, and *Thermobia domestica* (Pack.), *O. mercator*, *Tribolium castaneum* and *T. confusum* were relatively abundant within the mounds. Although there was no apparent infestation by *C. gonagra* in samples from the port, examination showed this Bruchid and *O. mercator* to be the most important species present at the bottom and top of the mounds, respectively. *T. castaneum* and *T. confusum* occurred chiefly in groundnuts and débris at the bottom.

Groundnuts for seed that had been in store in native bamboo containers sealed with mud or cow dung for only three months were heavily attacked by termites and also by *A. sordidus* and *O. mercator*. Similar groundnuts in temporary government stores of bamboo, adobe or sheet zinc, in which the storage period is two or three months, were infested in all except an adobe store thatched with dry grass. In the temporary stores and in permanent ones of stone, white-washed or faced with cement, with cement floors and zinc roofs, *O. mercator*, *T. castaneum* and *T. confusum* were the most important species, followed by *Corcyra cephalonica* and *E. cautella*, which were relatively abundant, and *Thermobia domestica*, *D. ater*, *Alphitobius diaperinus* (Panz.) (*ovatus*, auct.), *A. laevigatus* (F.) (*piceus* (Ol.)), *Tenebroides mauritanicus* and *Xylocoris* (*Piezostethus*) sp. *Caryedon gonagra* occurred in varying abundance, but was predominant, with *O. mercator*, in a permanent store and relatively abundant, especially in the oldest groundnuts, in another, in which *Thermobia domestica* and *X.* (*P.*) *flavipes* Reut. were also particularly numerous. *C. gonagra* was also found with large numbers of *Tribolium castaneum* and *T. confusum* in débris and dust between the top of the walls and the rafters. The last two species and a heavy infestation of *Aphanus sordidus* occurred in groundnut refuse in a temporary store. Large numbers of *Thermobia domestica* and also *O. mercator*, *Alphitobius diaperinus*, *Tribolium castaneum* and *T. confusum* were found in an empty temporary store of wood, but only *Alphitobius* spp. were present in one of bamboo. *O. mercator* was numerous and *C. gonagra* present in groundnuts eight days after they had been shelled and put in sacks in a permanent store, but, after a further seven days, numbers of *O. mercator* had fallen considerably and the most important species were *Carpophilus dimidiatus* (F.) and, to a lesser extent, *T. confusum* and *T. castaneum*. In permanent stores at ports in which groundnuts had been stored since the beginning of the season, the principal insects were *Corcyra cephalonica*, *E. cautella*, *D. ater*, *O. mercator*, *A. laevigatus* and *T. confusum*; *Thermobia domestica*, *Caryedon gonagra* and *A. diaperinus* were also common.

Lists of insects found on the growing crop and in a cargo boat used for transporting groundnuts are given in two appendices. The former included *Aphanus apicalis* and *Zophosis quadrilineata* (Ol.), which also occurred in groundnuts next to the soil in an outdoor mound. The boat was practically free from infestation, but, of the species common to it and the stores, the most numerous were *D. ater*, *Alphitobius laevigatus*, *Tribolium confusum* and *T. castaneum*.

Bowden (J.) & Ingram (W. R.). **Spraying Trials on Peasant Cotton in Uganda in 1957.**—*Emp. Cott. Gr. Rev.* **35** no. 4 pp. 239–243, 5 graphs, 3 refs. London, 1958.

Trials in Uganda over ten years on the control of pests of cotton by means of insecticides, mainly in the northern areas, culminated in an extensive series of tests on peasant-grown cotton in 1957. These were based on conclusions from the earlier work that spraying is more effective than dusting, that DDT applied at 1 lb. per acre four times at ten-day intervals gives a considerable reduction in the damage usually ascribed to *Lygus*, that a spray applied at some time during the growth period of 6–14 weeks invariably formed part of the most successful spray schedules, and that a simple double-acting syringe pump, capable of spraying at 8–12 gal. per acre, such as is already available, would be adequate for use. The tests, which were carried out in the Eastern and Northern Provinces, involved four applications of DDT at 1 lb. per acre from a miscible liquid by means of the pump, and the following is virtually the authors' summary of the results.

Significant increases of yield were shown to result from spraying S47 cotton, though economic returns accrued only from cotton sown early (May to mid-June). It is also probable that economic returns result from spraying BP52 cotton in Bunyoro, although the results obtained in this area were not so conclusive as those obtained from the S47 zone. Data obtained from unsprayed plots confirmed that a linear relation exists between planting date and yield, and that later plantings progressively reduce yield.

Pollard (D. G.). **Feeding of the Cotton Aphid (*Aphis gossypii* Glover).**—*Emp. Cott. Gr. Rev.* **35** no. 4 pp. 244–253, 8 figs., 12 refs. London, 1958.

The following is the author's summary. The stylets of *Aphis gossypii* Glov. pass mainly intercellularly through the leaf epidermis and mesophyll of Egyptian and American cottons. Some intracellular penetration may occur in both tissues: entry through the epidermis is rarely via a stoma. The stylets follow an indirect path to the vascular tissue (mainly phloem) in which feeding occurs. Penetration through the phloem takes place along the middle lamellae and is accompanied by sheath formation. Stylet sheath and track are well developed except where epidermal and mesophyll cells are closely packed. The rate of insertion of the stylets is rapid in epidermis and mesophyll but drops appreciably in the phloem: they come to rest in the latter some 30 minutes after the commencement of insertion. There is no evidence for diffusion of saliva through the leaf tissue. Plasmolysis is rare—except in the phloem where it is only slight—and chlorosis is absent. Slight blockage of phloem cells may be caused by branched tracks.

Childs (D. P.). **Warehouse Fumigation of Flue-cured Tobacco with HCN to control the Cigarette Beetle.**—*J. econ. Ent.* **51** no. 4 pp. 417–421, 3 figs. Menasha, Wis., 1958.

Investigations on the spatial distribution of the gas obtained when hydrogen cyanide was applied by two different dispensing systems were carried out in Virginia in 1957 in warehouses containing hogsheads of tobacco infested by *Lasioderma serricorne* (F.); 16 oz. fumigant per 1,000 cu. ft. was pumped in in 40 minutes at a pressure of 90 lb. per sq. in., and the period of fumigation was 72 hours, during which gas samples were taken at various points. Uniform distribution was obtained in four hours in a warehouse in which the

gas was distributed from rubber hose lines laid on the floor of the central aisle and in one hour in one in which it was also released from permanent overhead pipes parallel with the aisle and bisecting the halves. This dosage resulted in concentrations of about 4 oz. per 1,000 cu. ft. after four hours, but they fell to less than 2 oz. after 24–72 hours, and the larvae were killed by it in other tests only to a depth of 3 in. in the tobacco. An additional application of 16 oz. after eight hours raised the concentration to 10 oz. after 12 hours and to over 2 oz. after 72 hours, and gave high kills of larvae at depths of 3–9 in.

In three other warehouses, treatment with 32 or 24 oz. HCN or with 16 oz. followed eight hours later by an additional 16 oz. showed little difference in concentration-time values throughout the experiment, but the higher dose gave appreciably higher mortality of larvae at depths of 5 in. or more. Slightly better penetration was possibly obtained by releasing the fumigant all at once. Weekly trap records showed that dosages of 32 and 16 oz. were more and less effective, respectively, than one of 24 oz.

Madsen (H. F.) & Hoyt (S. C.). **Investigations with new Insecticides for Codling Moth Control.**—*J. econ. Ent.* **51** no. 4 pp. 422–424, 5 refs. Menasha, Wis., 1958.

Orchard tests of new insecticides for the control of *Cydia* (*Carpocapsa*) *pomonella* (L.) on pear in northern California were continued in 1956–57 [*cf. R.A.E.*, A **45** 348]. Sprays were timed by catches in bait pans and were usually applied at an average rate of 750 U.S. gal. per acre; quantities of insecticide are of wettable powder, unless otherwise stated, per acre.

In 1956, sprays were applied three times at about monthly intervals from 1st May, and it was found that 14·2 lb. 25 per cent. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], 7·1 lb. 25 per cent. diazinon with 7·1 lb. 50 per cent. DDT, 7·5 U.S. quarts 48 per cent. Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] (emulsion concentrate), 30 lb. 50 per cent. Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] and 750 g. of a spore preparation of *Bacillus thuringiensis* failed to give satisfactory control, 14–15 lb. 25 per cent. Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate] gave variable results, showing promise in one test, but giving poor control in another, 15 lb. 25 per cent. Hercules AC-528 [2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate)] showed some promise, and 45 lb. ryania, 11 lb. 50 per cent. Sevin (1-naphthyl N-methylcarbamate), 15 lb. 25 per cent. Guthion [O,O-dimethyl S-(4-oxobenzotriazino-3-methyl) phosphorodithioate] and 7·1 lb. 50 per cent. DDT with 7·1 lb. 25 per cent. parathion gave excellent control, comparable with that from 15 lb. 50 per cent. DDT.

In 1957, when sprays were applied on 13th–14th May and 6th and 26th June, 10·5 lb. 50 per cent. Sevin and 22 lb. 15 per cent. Guthion gave good control of *C. pomonella*, Guthion also controlled *Panonychus ulmi* (Koch), and both materials reduced a fairly heavy population of *Lithocolletis* sp. to a low level; 21 lb. ryania, with a spreader and adhesive, failed to reduce fruit injury adequately in one orchard.

Heavy infestation by *C. pomonella* was found in an apple orchard after treatment with a full DDT programme in 1956, and a field test there in 1957 strongly indicated the development of resistance to this compound. Four spray applications were made, on 6th May, 10th June, 18th July and 12th September, and 6·8 U.S. pints 50 per cent. Trithion emulsion concentrate, 40·2 lb. 50 per cent. ryania, 11·4 lb. 50 per cent. Sevin and 15·4 lb. 25 per cent. ethion [O,O,O′,O′-tetraethyl S,S′-methylene bisphosphorodithioate] gave satisfactory control of a high population, whereas 13·6 lb. 50 per cent.

DDT did not. Trithion and ethion controlled *P. ulmi*, and Sevin prevented an increase of *Aphis pomi* Deg. No serious injury to either pear or apple was caused by the insecticides.

Michelbacher (A. E.) & Hitchcock (S.). **Induced Increase of Soft Scales on Walnut.**—*J. econ. Ent.* **51** no. 4 pp. 427–431, 8 refs. Menasha, Wis., 1958.

The following is substantially the authors' abstract. One of the problems confronting growers of walnuts in California is the marked increase in the population of soft scales that has resulted from interference by certain insecticides, such as DDT, with effective control by Hymenopterous parasites [*cf. R.A.E.*, A **45** 479, etc.]. Because of their small size, the parasites are adversely affected by relatively small amounts of insecticide, and it was found that these occurred not only as a result of treatments applied directly to the trees but also as a result of the drift of insecticides through the orchards when adjacent or even distant fields are treated. The increases also followed the use of systemic insecticides in sprays. The three species of soft scales involved are *Eulecanium* (*Lecanium*) *pruinosum* (Coq.), *E.* (*L.*) *corni* (Bch.) and *E.* (*L.*) *cerasorum* (Ckll.). The first two occur as a complex, and typical forms and atypical forms were found that more or less blended into one another; the typical form of *E. pruinosum* was more susceptible to parathion than was the typical form of *E. corni*. In experiments, the scales were most easily controlled during July and August, a month or two after hatching, when 2 lb. 25 per cent. wettable parathion with 0·75 U.S. gal. light summer oil emulsion in 100 U.S. gal. water per acre, applied with an air-carrier sprayer was effective against all three species. After leaf drop and until about 1st March, all were effectively controlled by 5 lb. of the wettable parathion with 2–4 U.S. gal. oil emulsion in 150–200 U.S. gal. water per acre applied in the same way. Control with insecticides was not possible after the second moult, which usually occurs during March.

Haramoto (F. H.) & Boyle (W. W.). **Control of the Cyclamen Mite on *Jasminum sambac* (L.) Ait. in Hawaii.**—*J. econ. Ent.* **51** no. 4 pp. 431–433, 4 refs. Menasha, Wis., 1958.

The following is based on the authors' abstract. In the spring of 1956, about 90 per cent. of the shoots of *Jasminum sambac* in fields in Honolulu were infested by *Steneotarsonemus pallidus* (Banks) and flower production was severely reduced. In control experiments carried out in March and April, sprays of wettable endrin or parathion or emulsifiable Metacide [methyl-parathion and parathion] halved the numbers of infested shoots, but parathion and Metacide damaged the plants severely [*cf. R.A.E.*, A **46** 74]. Applications every 2–3 weeks from mid-July, at 1 pint per 100 gal., of an emulsion concentrate containing 1·6 lb. endrin per U.S. gal., gave complete control within two months. The continued use of this material in commercial plantings apparently exterminated the mite, as no infested shoots could be found in September 1957.

Hills (O. A.). **Effect of Curly Top-infective Beet Leafhoppers on Watermelon Plants in different Stages of Development.**—*J. econ. Ent.* **51** no. 4 pp. 434–436, 2 figs., 2 refs. Menasha, Wis., 1958.

Experiments were carried out in Arizona in 1955 to determine the effect on watermelon of feeding by *Circulifer tenellus* (Baker) infected with the

virus of curly top. When plants were exposed in the greenhouse to feeding for 4–6 days, those in the cotyledon stage were more severely affected than those in the two-leaf stage, and similar results were obtained in field-plot tests, 64 per cent. of plants in the cotyledon stage and 9 per cent. in the two-leaf stage being affected. Periodic measurement of runners and leaf blades indicated definite retardation of growth in plants exposed in the cotyledon stage, but only a tendency towards it in those exposed in the two-leaf stage, and it is concluded that little damage to watermelon need be expected unless infestation by *C. tenellus* is heavy when the plants are in the cotyledon stage. Comparison with earlier experiments [*R.A.E.*, A **42** 380] indicated that watermelons are less susceptible to the virus than are cantaloup melons.

Richardson (H. H.) & Roth (H.). **Observations on Methyl Bromide Fumigation of Fruit under Plastic Tarpaulins and at Cold Temperatures.** —*J. econ. Ent.* **51** no. 4 pp. 436–438, 2 figs., 3 refs. Menasha, Wis., 1958.

Methyl bromide was used early in 1955 to fumigate boxes of imported plums, peaches and other fruits found to be very lightly infested by larvae of *Eulia* sp. and adults of a predacious Coccinellid, *Eriopis connexa* (Germ.), on arrival in covered barges in New York, and observations were made on gas concentration and distribution under the unusual conditions provided. Cracks in the barge flooring were caulked, and the boxes of fruit were stacked on wooden pallets and covered with tarpaulins, with a space left round and over the stacks. Doses of 4 lb. methyl bromide per 1,000 cu. ft. at a fruit temperature of 33°F. in the first test and of 3–3·5 lb. at 40–46°F. in later ones were volatilised in a coil of tubing immersed in hot water and injected into the air stream by means of a fan above and in front of the load, usually at the rate of 2–3 lb. per minute. The fan was operated throughout the fumigation period of two hours in the first test, but resulted in low and uneven gas concentrations. In the later tests, two fans, pointing from each end to the centre of the load, were operated for the first 30 minutes, and these produced evenly distributed gas concentrations of about 70–80 per cent. of the original dosage after 30 minutes and maintained them for another 30 minutes, after which they dropped slowly to about 65–70 per cent. towards the end of the two hours. As separate tests showed that the tissue-paper fruit wrappers were permeable to the gas, they did not have to be removed during fumigation. The treatment appeared to give good insect control, with no damage to the fruits, and small-scale tests in which plums were fumigated with 3–5 lb. methyl bromide per 1,000 cu. ft. for two hours or 4 lb. for three hours at 45–50°F. indicated a good margin of tolerance of this fumigant.

Wolfenbarger (D.) & Hibbs (E. T.). **Insecticides and Spray Schedules for the Control of Cabbage Leaf feeding Lepidoptera.**—*J. econ. Ent.* **51** no. 4 pp. 443–445, 1 fig., 2 refs. Menasha, Wis., 1958.

The following is based largely on the authors' abstract. Insecticides and schedules of application were evaluated in Iowa in 1956–57 for the control of larvae of *Plutella maculipennis* (Curt.), *Pieris rapae* (L.) and *Trichoplusia ni* (Hb.) feeding on the leaves of cabbage grown for the fresh market in July. Sprays were applied at 50 U.S. gal. per acre, 12 times at weekly intervals from 17th May (four weeks before heading) until harvest on 2nd August in 1956 and five times at weekly intervals from 22nd June (a week before

heading) until 17th July, a week before harvest, in 1957. Relative amounts of leaf damage caused by the larvae were visually rated in five classes, and the results were analysed statistically. In 1956, 0·25 lb. endrin per acre gave significantly better protection than other treatments, and 0·75 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], 0·33 lb. parathion and 0·5 lb. Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] were significantly superior to 1 lb. DDT per acre. In 1957, endrin and parathion at 0·3 lb. per acre were both very effective, and 0·3 lb. Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] almost as good. A test of spray timing showed that applications of 1 lb. DDT per acre once a fortnight were significantly inferior to the same treatment or to 2 lb. toxaphene applied once a week and to 0·33 lb. parathion applied once a fortnight. Weekly applications of parathion gave the best protection. Several other organic insecticides were of little value.

Bibby (F. F.). **Notes on Thrips of Arizona.**—*J. econ. Ent.* **51** no. 4 pp. 450–452, 5 refs. Menasha, Wis., 1958.

A list is given of 24 species of thrips collected in Arizona in 1953–58, showing their food-plants and the localities and dates of collection. They belong to 14 genera, and *Frankliniella occidentalis* (Perg.) appeared to be the dominant species, having been taken on some 40 different plants. *F. gossypiana* Hood, *Kurtomathrips morrilli* Moult. and *Scirtothrips* sp. (probably undescribed) are recorded as pests or potential pests of cotton.

Glass (E. H.). **Laboratory and Field Tests with the Granulosis of the Red-banded Leaf Roller.**—*J. econ. Ent.* **51** no. 4 pp. 454–457, 5 refs. Menasha, Wis., 1958.

The following is substantially the author's abstract. A granulosis caused by the virus named *Bergoldia clistorhabdion* has occasionally been observed in larvae of *Argyrotaenia velutinana* (Wlk.) in apple orchards in New York [*cf.* also *R.A.E.*, A **41** 210], but was never abundant enough to influence population levels appreciably. In the laboratory, first-instar larvae readily contracted the disease when fed on apple leaves treated with suspensions of triturated diseased larvae at concentrations varying from 1 last-instar larva per litre to 1 per 512 l. water, disease symptoms and death occurring sooner at the higher than at the lower concentrations. Suspensions of triturated larvae at rates of 5, 50 and 100 per 100 U.S. gal. spray applied to apple trees during the hatching of the first generation in 1954 infected and destroyed most of the larvae, but not before they had damaged many fruits.

Dobson (R. C.). **The Effect of Spotted Alfalfa Aphid Protection by Systemic Insecticides and Varieties on Alfalfa Production the Year following Seedling Protection.**—*J. econ. Ent.* **51** no. 4 pp. 457–458, 1 ref. Menasha, Wis., 1958.

Protection of seedling stands of lucerne from *Therioaphis maculata* (Buckt.) has become necessary in New Mexico [*cf. R.A.E.*, A **46** 177], and tests were made in 1956–57 of the effect of infestation in autumn on the yield of several varieties in the following year and on the difference in production between stands of several varieties that had or had not been protected from infestation.

The two tolerant varieties, Lahontan and New Mexico 16, were not seriously injured by aphid attack during the seedling stage, Ranger and African, classed as semi-tolerant, were injured but recovered enough to produce as much growth as the best of the treated plots at the end of the first production year, and New Mexico 11-1, an improved susceptible variety, produced significantly higher yields than did New Mexico Common. Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate], Bayer 23129 [O,O-dimethyl S-2-(ethylthio)ethyl phosphorodithioate] and Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] were applied at 1 lb. per acre in granules in the furrows at sowing time, and all increased the total yield significantly. Bayer 19639 increased the yield of all non-tolerant varieties to that of protected tolerant varieties.

Tippins (H. H.). **Granulated Insecticides for the Control of Seed Weevils on Crimson Clover.**—*J. econ. Ent.* **51** no. 4 pp. 459–460, 4 refs. Menasha, Wis., 1958.

In field tests in which granular insecticides were broadcast on 28th–30th March 1956 over crimson clover [*Trifolium incarnatum*] in the pre-bloom stage in three localities in Georgia, 2·5 lb. aldrin, dieldrin or heptachlor per acre in 2, 5 and 2·5 per cent. granules, respectively, caused significant reductions in populations of *Hypera meles* (F.) and *H. nigrirostris* (F.), whereas 10 lb. toxaphene in 20 per cent. granules did not. The yield of seed was highest in plots receiving heptachlor or dieldrin. In further tests of these materials in 1957, applications of 1 or 2 lb. dieldrin on 30th March or 12th April, of 1 or 2 lb. heptachlor on the first date and of 0·5 or 1 lb. on the second in one place and similar applications on 2nd and 15th April in another all controlled the weevils and increased the yield. Early applications resulted in slightly better control than late ones, and heptachlor in slightly bigger yields than dieldrin, but the differences were not usually significant.

Didriksen (R. A.) & Lilly (J. H.). **Granulated Insecticide Formulations for Wireworm Control.**—*J. econ. Ent.* **51** no. 4 pp. 463–464, 2 graphs, 1 ref. Menasha, Wis., 1958.

Laboratory tests are described in which larvae of *Melanotus communis* (Gylh.) were transferred to soil containing granular formulations of 2, 5, 10, 20, 30 or 40 per cent. aldrin or heptachlor on vermiculite or of the first four concentrations on 30–60 mesh attapulgite clay at dosages corresponding to 1·25, 2·5 or 5 lb. insecticide per acre. Counts made after 21 days showed that vermiculite was a very satisfactory carrier for both insecticides and compared favourably with the clay. The insecticidal effect of the treatments decreased as the concentration of toxicant in the granules increased and the number of particles decreased, the differences being significant with clay but not with vermiculite.

Noon jr. (Z. B.). **Food Habits of the Khapra Beetle Larva.**—*J. econ. Ent.* **51** no. 4 pp. 465–467, 8 refs. Menasha, Wis., 1958.

In tests carried out in Arizona under outdoor conditions from July to December and then at 35°C. [95°F.], first-instar larvae of *Trogoderma granarium* Everts were confined on a variety of animal and vegetable foods and the numbers that died, gave rise to adults or remained in the larval stage and the length of the developmental period were noted; dead larvae or

adults were removed so that they should not be eaten by the survivors. The results showed that although the larvae live mainly on vegetable matter [*cf. R.A.E.*, A **44** 172], they will feed on material of animal origin. They developed rapidly on dead insects, with the exception of honey bees, but less successfully on dead vertebrates or on animal products other than dried milk. One of 51 larvae completed its development on sound kernels of milo sorghum; some other seeds were too hard or too hairy for the larvae to penetrate them [*cf.* **47** 302]. Pollen seemed to form the best diet, almost half the insects completing their life-cycle on it. The time necessary for development was about the same on vegetable or animal diets, but comparisons of pairs of materials indicated that deer meat was preferred to dead insects, which were followed in order by oatmeal, cracked milo sorghum, pollen and cracked barley. The larvae will evidently develop on a wide variety of materials commonly found near storage areas, and such foods as pollen and dead insects provide convenient natural reservoirs from which new infestations might arise.

Yust (H. R.) & Cevallos G. (M. A.). **Insecticide Protection against** *Pagiocerus fiorii* **in Ecuador.**—*J. econ. Ent.* **51** no. 4 pp. 468–469, 3 refs. Menasha, Wis., 1958.

Soft maize grown in the mountains of Ecuador is frequently destroyed in storage by *Pagiocerus fiorii* (Egg.), which infests it in the field before the grain is dry enough to harvest and may attack more than 50 per cent. of it within 3–4 months of storage [*cf. R.A.E.*, A **46** 98]. In laboratory tests with grain harvested 1–2 months previously in Cumbayá, where the Scolytid is a serious pest, shelled maize and maize on the cob showing 0·7 and 0·3 per cent. infestation, respectively, were thoroughly mixed with dust insecticides to give doses of 50 parts per million methoxy-DDT (methoxychlor), 5–10 p.p.m. lindane [almost pure γ BHC], 8 p.p.m. malathion or 0·18 per cent. pyrenone (0·8 per cent. piperonyl butoxide and 0·05 per cent. pyrethrins in fibrous talc) and stored in sacks in the presence of a heavy infestation. Examination at monthly intervals showed practically no infestation for six months, which is about the average storage period, after which insect numbers increased in the maize treated with γ BHC or Pyrenone; methoxy-DDT and malathion continued to give protection for more than nine months.

In large-scale tests, treatment with 1 lb. Pyrenone per ten bushels or with 1 lb. 1 per cent. γ BHC per 1,000 lb. gave good protection of shelled maize for at least 4–6 months if applied before the infestation reached 1 per cent., but not if it was higher, whereas treatment of infestations ranging up to about 10 per cent. with 50 p.p.m. methoxy-DDT prevented increases in population for at least three months.

Doane (C. C.). **Insecticides to prevent the Emergence of** *Scolytus multistriatus*.—*J. econ. Ent.* **51** no. 4 pp. 469–471, 5 refs. Menasha, Wis., 1958.

In Connecticut, *Scolytus multistriatus* (Marsham) is one of the principal vectors of the fungus that causes Dutch elm disease [*Ceratocystis ulmi*], and the most important carriers are the beetles that emerge and leave the bark in the spring, since elms are most susceptible to infection during spring and early summer [*cf. R.A.E.*, A **29** 563]. In laboratory tests of insecticides to prevent such emergence, emulsion sprays containing 12 per cent. DDT, 6 per cent. dieldrin or 6 per cent. lindane [almost pure γ BHC] were applied to elm bark to moisten it slightly while the insects were still in

the larval stage. Only γ BHC penetrated well, and none of the insecticides prevented transformation to the adult stage, but the percentages of beetles that died without leaving the bark were 22, 51 and 97, respectively, as compared with 17 for no treatment, and the percentages that died within 24 hours after leaving it were 37, 44 and 2, as compared with 7. Of those that died before leaving the bark, most were found on the surface for DDT and dieldrin and most in the pupal cells for γ BHC and no treatment.

In two replicated field tests in 1957, emulsion sprays containing DDT, dieldrin, γ BHC or malathion were applied so as thoroughly to wet the bark of infested elm logs on 22nd March, when *S. multistriatus* was in the larval or pupal stage, or on 6th May. All sprays penetrated well, but did not kill the insects until they transformed to adults. Sprays containing 0·5–1 per cent. γ BHC or dieldrin were the most effective in reducing emergence from the bark, 1–2 per cent. DDT was less effective, and 0·5–1 per cent. malathion was the least effective, though it effected appreciable mortality.

Clower (D. F.). **Damage to Corn by the Southern Green Stink Bug.**—*J. econ. Ent.* **51** no. 4 pp. 471–473, 4 figs. Menasha, Wis., 1958.

The following is substantially the author's abstract. Adults of *Nezara viridula* (L.) were found severely injuring maize in Louisiana during the summer of 1957. Young plants showed degrees of damage varying from slight wilting of the central leaves of the whorl to death of the entire plant, and on older ones, the ears became distorted and the grain failed to develop. In tests in which known numbers of bugs were caged on young plants, four pairs caused severe wilting in two days and two or more pairs high plant mortality in 13 days. When bugs were caged on the developing ears of older plants, deformity occurred when the level of infestation reached two pairs per ear.

DeBach (P.). **The Role of Weather and entomophagous Species in the natural Control of Insect Populations.**—*J. econ. Ent.* **51** no. 4 pp. 474–484, 1 graph, 17 refs. Menasha, Wis., 1958.

The following is virtually the author's abstract. Weather sets the basic framework within which certain average but fluctuating insect population densities may be obtained in the absence of other possible regulatory factors. These average population densities may be very high or very low. Weather regulates insect populations only by being of sufficient severity to restrict the size, quality (including food and favourability), or numbers of habitable spots in a given area, that is, its effect is obtained through interaction with microenvironments. If overlying weather severity in a given spot or area is not relatively great, then, theoretically, populations will be able to increase indefinitely over a period of time unless limited by other factors. Illustrations of population regulation by weather and methods of proof of such regulation are discussed.

The other principal factors capable of regulating insect population densities are natural enemies (parasites, predators and pathogens), food (quantity and quality), interspecific competition (other than natural enemies) and intraspecific competition. The last three factors usually do not control populations at low (uneconomic) levels and hence are not generally important factors in applied insect ecology.

Natural enemies may regulate insect populations at low levels even if all other factors are exceptionally conducive to increase. Several experimental methods for proving the extent of regulation of insect populations by

entomophagous species are reviewed [*cf. R.A.E.*, A **44** 381, etc.], and 13 examples of adequate proof of control by natural enemies are listed. A detailed case history of proof of low density population regulation of *Aonidiella aurantii* (Mask.) on *Citrus* in California by its natural enemies is given, and it is shown that reductions of effectiveness of natural enemies by adverse factors can result in different average population densities of the scale, even on adjacent trees.

Shorey (H. H.) & Gyrisco (G. G.). **The Effect of Entry into Dieldrin-treated Soil upon Adults of the European Chafer.**—*J. econ. Ent.* **51** no. 4 pp. 486–488, 4 graphs, 5 refs. Menasha, Wis., 1958.

In tests carried out in New York on the control of *Amphimallon majalis* (Razoum.) in meadow land [*cf. R.A.E.*, A **44** 234, etc.], one or more periods of adult flight and oviposition, which take place during June and July each year, sometimes occurred between the application of insecticides to the soil surface and the subsequent determination of larval populations. Part of the population decrease found might have been due to the effects of the insecticide on the adults, which leave the soil to pair and re-enter it to oviposit and shelter during the day, and this possibility was therefore investigated.

When equal numbers of adults collected from trees were caged over untreated plots and plots that had been treated with dieldrin at the rate of 2 lb. per acre in granules five days before, more than twice as many emerged from the untreated as from the treated soil on the next five evenings; applications ten weeks or a year before were still more effective. When adults in similar cages were allowed to enter the soil more than once, many of those over untreated soil did so several times, whereas few of those exposed to treated soil could fly after one night in the soil. In both experiments, males were affected more severely than females. Females exposed to dieldrin laid fewer than half as many eggs as the others, but the eggs hatched normally.

It is concluded that at least half the reduction in numbers that would have been evident during autumn sampling of larval populations in the treated plots would have been due to the effect of dieldrin on the adults.

Davis (J. W.), Parencia jr. (C. R.) & Cowan jr. (C. B.). **Control of Thrips and the Cotton Fleahopper with Sprays in central Texas in 1957.**—*J. econ. Ent.* **51** no. 4 pp. 489–490, 3 refs. Menasha, Wis., 1958.

Heavy infestation of cotton by *Psallus seriatus* (Reut.) and *Frankliniella* sp. occurred in central Texas in 1957, and emulsion sprays were tested for their control in June and July. Against *Frankliniella*, three applications, at intervals of about a week, of 0·75 or 1·5 lb. toxaphene, 0·1 lb. dieldrin, 0·25 lb. methyl-parathion, 0·13 or 0·26 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], 0·5 lb. Sevin [1-naphthyl N-methylcarbamate] or 0·25 lb. Monsanto CP-7769 [hexaethyl ethylthio-methylidinetriphosphonate] per acre were very effective and 0·31 lb. malathion and 0·5 lb. Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] somewhat less so. The action of toxaphene was not improved by the addition of methyl-parathion or malathion.

Against *P. seriatus*, 2–3 applications were made at intervals of 12–14 days, and 0·2 lb. Guthion, 0·75–1·5 lb. toxaphene and 0·5 lb. Sevin per acre gave good and 0·25 lb. Sevin and 0·25 lb. CP-7769 fair control; 0·5 lb. Thiodan gave poor results. Heavy infestation by *Heliothis zea* (Boddie) developed

in two of the tests, and either eight sprays of toxaphene and DDT or six of 0·4 lb. dieldrin with 1·5 lb. DDT and two of 1·45 lb. γ BHC and 1·25 lb. DDT per acre were applied between 9th July and 20th August for its control; these masked the effects of the earlier sprays on yield, but it was generally increased on the other treated plots. Sevin caused noticeable damage to the plants wherever it was used.

Pruess (K. P.) & Weaver (C. R.). **Estimation of Red Clover Yield Losses caused by the Clover Root Borer.**—*J. econ. Ent.* **51** no. 4 pp. 491–492, 1 graph, 3 refs. Menasha, Wis., 1958.

The following is virtually the authors' abstract. Reductions in hay yields from the second cutting of red clover [*Trifolium pratense*] caused by *Hylastes* (*Hylastinus*) *obscurus* (Marsham) in Ohio were estimated by multiple regression analyses in 1956. Variables included were the number of insects, the crown diameter of the root, the square of the crown diameter and foliage weight. Both foliage weight and number of insects per root were found to increase as crown diameter increased, the relations being curvilinear. The regression of foliage weight on insect numbers, independent of crown diameter, showed an increase in insect numbers to result in a decrease in foliage weight. Calculations indicated that an average of 1·5 insects per root resulted in a reduction of 5·5 per cent. in yield.

MacCollom (G. B.). **Control of Insects affecting Birdsfoot Trefoil Seed Production in Vermont.**—*J. econ. Ent.* **51** no. 4 pp. 492–494, 2 graphs, 6 refs. Menasha, Wis., 1958.

Injurious insects seriously limit the seed production of birdsfoot trefoil (*Lotus corniculatus*) in Vermont. Observations over several years showed that nymphs of *Philaenus leucophthalmus* (L.) were numerous every spring and that the Mirids, *Lygus lineolaris* (P. de B.), *Adelphocoris lineolatus* (Goeze), *A. rapidus* (Say) and *Plagiognathus* spp., were also present, though their abundance varied widely from field to field and populations were appreciably lower on small than on large areas. In tests, emulsion sprays were applied at 20 U.S. gal. per acre on 29th May 1956 to trefoil sown in May 1954, and 0·2 lb. endrin, 2·25 lb. toxaphene, and 1 lb. DDT, alone or with 0·25 lb. dieldrin, gave sufficient control of *Philaenus* and the Mirids to protect the plants throughout bud development, bloom and pod growth, thus resulting in significant increases in the numbers of umbels per stem and of pods per umbel. The flowering on the treated plots was visibly more dense and uniform and the flowering period of shorter duration than on untreated ones, and these were considered good criteria for measuring plant protection by the insecticides. The same sprays applied on 8th May 1957, before a period of variable weather that prolonged hatching and delayed plant growth, gave only partial insect control and caused no significant increases in numbers of umbels per stem or of pods per umbel. The honey-bee population was adequate for pollination.

Dobson (R. C.). **Effects of Systemic Insecticide Seed Treatments on two Varieties of Cotton.**—*J. econ. Ent.* **51** no. 4 pp. 495–497, 4 refs. Menasha, Wis., 1958.

When applied to cotton seed in New Mexico at the rate of 1 lb. actual toxicant per 25 lb. seed, 44 per cent. Thimet [O,O-diethyl S-ethylthiomethyl

phosphorodithioate] and 50 per cent. Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] in carbon, applied as slurries, and 50 per cent. Bayer 19639 in emulsion form, applied as a spray, all reduced seedling stands of the variety Pima S-1, and Thimet retarded flowering and reduced growth during the early part of the season. Similar treatments applied to seed of the variety Acala 1517C also reduced growth, and this variety appeared to be slightly more sensitive to the two insecticides. Neither variety suffered a decrease in yield.

Wessling (W. H.). **Resistance to Boll Weevil in mixed Populations of resistant and susceptible Cotton Plants.**—*J. econ. Ent.* **51** no. 4 pp. 502–506, 3 graphs, 5 refs. Menasha, Wis., 1958.

The following is substantially the author's abstract. The reliability of resistance to attack by *Anthonomus grandis* Boh. conferred on cotton plants by the mutant gene H_2 [*cf. R.A.E.*, A **46** 338] was tested in plots comprising different proportions of the resistant, mutant strain, Pilose, and the susceptible variety, All-in-one, or Pilose alone. The individual plots were isolated by barrier strips of maize, and a uniform infestation of weevils provided. The degree of resistance was measured inversely by noting the proportion of squares with oviposition punctures. Pilose showed a significantly lower proportion of these throughout the investigation, but a slight though consistent increase in number of punctures with increase in the number of susceptible plants in the mixture was noticed in both Pilose and All-in-one.

Manglitz (G. R.). **Aestivation of the Alfalfa Weevil.**—*J. econ. Ent.* **51** no. 4 pp. 506–508, 7 refs. Menasha, Wis., 1958.

In view of the scarcity of adults of *Hypera variabilis* (Hbst.) (*postica* (Gylh.)) in lucerne fields during the summer in the eastern United States [*cf. R.A.E.*, A **43** 49], investigations were undertaken in Maryland in 1957 to discover where they are to be found at that time. Extensive soil sampling showed that most were in surface litter and soil beneath trees, hedgerows and fences bordering the fields. Records made at one field over a period of 13 days showed that the mean temperature was 3·1°F. higher in the centre of it than a few feet inside the woods surrounding it, so that the weevils possibly leave the fields to escape the high temperatures in them. No oviposition was observed when several hundred adults that emerged in early May were caged during the summer, and none occurred during the last months of life of overwintered adults that survived until July or August. Although it cannot be stated definitely that the few larvae present in summer result from eggs laid by overwintered adults, the latter live long enough to be responsible for them, and there is probably only one generation a year. Adults that had fed for a short period survived for several months without food, and dissections in mid-September, when the weevils return to lucerne, showed that ovarian development had not occurred during their absence from the fields; continued observations indicated that it was not complete until late October. The time spent away from lucerne therefore appears to be a period of true aestivation.

Wessling (W. H.). **Genotypic Reactions to Boll Weevil Attack in Upland Cotton.**—*J. econ. Ent.* **51** no. 4 pp. 508–512, 10 refs. Menasha, Wis., 1958.

The following is virtually the author's abstract. Mutant lines of Upland

cotton carrying any two of four mutant genes, H_1, H_2, *gl* and R_1, which promised to confer a certain degree of resistance to attack by *Anthonomus grandis* Boh. [*cf. R.A.E.*, A **46** 338], were tested in North Carolina together with lines having the same genetic background, but differing by opposite alleles to the genes under test. All mutant lines showed varying degrees of resistance to attack, the lines combining H_1 and H_2 showing it to the highest degree, and those combining *gl* and H_2, and *gl* and H_1, ranking second and third. Lines carrying the genes R_1 in combination with *gl* or H_2 were tested in a separate experiment. Both strains showed a relatively high degree of resistance. The main effects of the mutant genes, H_1, H_2 and *gl*, could be estimated only on the assumption that their interactions were unimportant. On this basis, the data obtained in the experiments indicate that H_2 contributed more to resistance than H_1, while *gl* had no significant effect.

Strong (R. G.) & Rawlins (W. A.). **Aster-yellows Virus Infection and Transmission by *Macrosteles fascifrons* (Stål) with Reference to Lettuce-yellows Prevention.**—*J. econ. Ent.* **51** no. 4 pp. 512–515, 8 refs. Menasha, Wis., 1958.

In the course of attempts in New York to rear populations of *Macrostcles fascifrons* (Stål) containing large proportions of individuals infected with the eastern strain of the aster-yellows virus, which were needed to test the effectiveness of insecticides in preventing transmission of the virus to lettuce, no differences were found in the infectivity of batches of insects that had fed on infected China asters (*Callistephus chinensis*) for periods of 3, 6 or 10 days, when a subsequent incubation period of 18 days was permitted. Two insects per plant were as successful as larger numbers in inoculating all healthy plants of *C. chinensis* after an infection feeding period of three days and an incubation period of 18 days, but the numbers of transmissions effected were much lower after incubation periods of 14 days or less. After feeding on an infected plant for not less than three days, followed by an incubation period of not less than 18–20 days, individuals transmitted the virus almost as readily after feeding on the healthy plant for ten minutes as for six hours, but transmission was much higher after feeding for 24 hours. Most individuals infected only one *Callistephus* plant per 24-hour period of confinement on groups of five plants, but 70–78 per cent. of them infected all but the first of 5–10 lettuce plants on which they were caged individually for 12–48 hours in serial transfers. Caging individuals for an hour on each of ten successive *Callistephus* plants did not give such consistent transmission.

Schesser (J. H.), Priddle (W. E.) & Farrell (E. P.). **Insecticidal Residues in Milling Fractions from Wheat treated with Methoxychlor, Malathion, and Lindane.**—*J. econ. Ent.* **51** no. 4 pp. 516–518, 3 refs. Menasha, Wis., 1958.

The following is substantially the authors' abstract. Milling tests were carried out to determine the insecticide residues in flour derived from wheat to which methoxy-DDT (methoxychlor), malathion or lindane [almost pure γ BHC] had been applied at several rates in 30–90 lb. dust or (except for methoxy-DDT) 5 U.S. gal. spray per 1,000 bushels. Some samples were milled 9–10 days after treatment, except for methoxy-DDT, and others after ageing for 18–24 months. Analysis of the wheat just before and after cleaning and of the flour, bran, shorts and germ showed that cleaning in most cases removed only a small amount of insecticide. The highest residues were in the bran and shorts, and less than 0·3 part per million remained in the

flour after either period from malathion applied at 2·5–7·5 p.p.m., 0·3–1·8 p.p.m. from methoxy-DDT applied at 5–50 p.p.m., and 1·3–2·6 p.p.m. from lindane applied at 2·5–7·5 p.p.m.

Abo-el-Ghar (M. R.) & Boudreaux (H. B.). **Comparative Responses of five Species of Spider Mites to four Acaricides.**—*J. econ. Ent.* **51** no. 4 pp. 518–522, 4 graphs, 21 refs. Menasha, Wis., 1958.

Tetranychus cinnabarinus (Boisd.), *T. lobosus* Boudreaux [*cf. R.A.E.*, A **46** 261], *T. desertorum* Banks and *T. tumidus* Banks are the most widely distributed Tetranychids on cotton in Louisiana, and the toxicity of dusts of sulphur, Aramite [2-chloroethyl 2-(p-tert.)butylphenoxy)-1-methylethyl sulphite], parathion and Phostex [a mixture of bis(dialkyloxyphosphinothioyl)-disulphides] to different stages of them and of *T. gloveri* Banks [*cf.* **47** 132] was tested in the laboratory; all mites were from non-resistant stocks. Parathion was the most and sulphur the least toxic material to all stages, with Aramite and Phostex about equal in effect. *T. desertorum* was the most and *T. tumidus* the least susceptible mite; *T. lobosus* approached *T. desertorum* in susceptibility, followed by the other two. The egg was the least susceptible stage in all species, and comparison of the results for nymphs and adults indicated that there was an affinity between parathion and Phostex, and that *T. tumidus* could be grouped with *T. gloveri*, and *T. lobosus* with *T. cinnabarinus*, an arrangement that agrees with the taxonomy of the species, based on morphology. Both parathion and Phostex were more toxic to adults than to nymphs for the first pair and to nymphs than to adults for the second. Aramite was more toxic to nymphs than to adults in *T. lobosus* and *T. cinnabarinus*, but equal in effect in the other two species, and sulphur was more toxic to the nymphs in *T. gloveri* and *T. lobosus* and to the adults in *T. tumidus*, and equal in effect in *T. cinnabarinus*. Nymphs and adults of *T. desertorum* showed about equal susceptibility in each case. The results indicate that all stages should be considered when an acaricide is evaluated and that the response of one species may differ from that of another.

Michelbacher (A. E.) & Hitchcock (S.). **Walnut Aphid Investigations in northern California.**—*J. econ. Ent.* **51** no. 4 pp. 527–532, 12 refs. Menasha, Wis., 1958.

In northern California, *Chromaphis juglandicola* (Kalt.) infests the leaves of walnut and reduces the nut crop by up to 50 per cent. The damage is most severe on early varieties, and most of it occurs before the leaves are fully expanded; severe infestation during this period stunts the leaves, causing a reduction in the size of the developing nuts, and the adverse effects may persist into the following year.

Schradan is the most effective of the insecticides tested against the aphid [*cf. R.A.E.*, A **45** 31, etc.], and investigations in 1955–57 showed that a single spray application affording 0·5 lb. schradan per acre in April or early May gave effective control for a year except at San José, where the aphid has developed resistance to parathion [*cf.* **43** 58] and possibly other phosphorus compounds; still better control was obtained with 0·75–1 lb. schradan per acre. Treatment must be applied before the foliage hardens for satisfactory results [*cf.* **44** 373], and effectiveness is influenced by plant vigour and thoroughness of application. Schradan also suppressed the complex of *Eulecanium* (*Lecanium*) *pruinosum* (Coq.) and *E.* (*L.*) *corni* (Bch.) and the mites, *Tetranychus pacificus* McG., *T. telarius* (L.) and *Brevipalpus*

lewisi McG., of which the last is increasing as a pest of walnut, but tended to increase populations of *E.* (*L.*) *cerasorum* (Ckll.) and *Panonychus ulmi* (Koch). Trees treated with schradan were generally in much better condition than others, and the exceptionally fine quality of their foliage may have been partly due to a stimulus other than that provided by the control of *C. juglandicola* and other sucking pests.

Of the other aphicides tested, 10–15 lb. 25 per cent. wettable ethion [O,O,O′,O′-tetraethyl S,S′-methylene bisphosphorodithioate], 1 lb. Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate] in emulsion concentrate and about 6 lb. 15 per cent. wettable Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] per acre showed promise, being apparently more effective than 1 lb. 25 per cent. wettable parathion or malathion when applied twice, in April and June.

Barnes (M. M.) & Ortega (J. C.). **Glycine-Sodium Hydroxide Solution as an Attractant for Walnut Husk Fly.**—*J. econ. Ent.* **51** no. 4 pp. 532–534, 3 refs. Menasha, Wis., 1958.

Since a bait of 3 oz. glycine and 4 oz. sodium hydroxide per U.S. gal. water is an excellent and fairly specific attractant for *Rhagoletis suavis completa* Cress. [*cf. R.A.E.*, A **30** 132], it can be used to indicate the beginning of adult emergence and so to time spray applications. To determine the length of time necessary for the solution to reach maximum attractiveness and the period for which this was maintained, solutions were prepared 1, 2, 4, 5 and 7 weeks before use, bait-pails containing them were hung in an infested peach orchard in California on 16th August 1956, and counts of the flies taken were made each day for six days. The results showed that solutions freshly prepared or one week old were significantly less attractive than those 2–7 weeks old and that the degree of attraction attained after a fortnight was maintained for at least seven weeks. It follows that the bait should be prepared a fortnight before it is required for use and that it can be used to measure field populations for some weeks before and after treatment if this is desired. The addition of 0·01 per cent. sodium lauryl sulphate increased the catch by about 50 per cent. and might be desirable where populations of the fly are low. In bait-pails exposed in 13 orchards in three counties of California between 16th and 23rd August 1957, females formed 67·8 per cent. of the total catch of 4,490 flies, although the sex ratio is known to be 1 : 1.

Yendol (W. G.) & Gould (G. E.). **The Effect of insecticidal Soil Drenches on the Growth of young Cabbage and Muskmelon Plants.**—*J. econ. Ent.* **51** no. 4 pp. 534–538, 5 refs. Menasha, Wis., 1958.

The following is substantially the authors' abstract. Insecticides in emulsified solution are commonly used as soil drenches for the control of *Hylemyia brassicae* (Bch.) by growers in Indiana when transplanting cabbage and related cruciferous crops and are occasionally applied for the control of cutworms round hills of melons. Some formulations have caused retardation of growth and even death of plants under field conditions, and emulsion formulations of six insecticides and the same formulations without the insecticides were therefore tested at six dilutions on young cabbage and 18 dilutions on young muskmelon plants in the greenhouse. The results, based on the number and weight of the surviving plants, indicated that muskmelon was more sensitive than cabbage and that, in general, the solvent-emulsifier

formulations were somewhat more phytotoxic than the corresponding complete emulsions. Of the six insecticides, aldrin and chlordane were less toxic and lindane [γ BHC] more toxic to the plants than were dieldrin, endrin and heptachlor.

Haynes (H. L.), Moorefield (H. H.), Borash (A. J.) & Keays (J. W.). **The Toxicity of Sevin to Goldfish.**—*J. econ. Ent.* **51** no. 4 p. 540, 2 refs. Menasha, Wis., 1958.

In view of the promising results given by Sevin (1-naphthyl N-methylcarbamate) against forest insects in the United States, its effect on other animals is of interest, and preliminary investigations were carried out with goldfish (*Carassius auratus*). In separate laboratory tests, technical Sevin and DDT were dissolved in 1 ml. ethanol and added to 2 litres water containing five fish, and 50 per cent. wettable Sevin was stirred directly into the water. The fish were kept without food for 48 hours with concentrations of 0·063–0·5 part per million technical DDT, 15–35 p.p.m. technical Sevin as the ethanol solution and 7·5–25 p.p.m. Sevin as the wettable powder and removed immediately they died. Final mortality counts showed that the LD50's were 0·11, 28 and 14 p.p.m., respectively; no mortality occurred in water containing only ethanol or the inert constituents of the wettable powder.

Boulanger (L. W.). **Tests on Control of the Codling Moth in Maine during 1957.**—*J. econ. Ent.* **51** no. 4 p. 542, 2 refs. Menasha, Wis., 1958.

The second seasonal generation of *Cydia* (*Carpocapsa*) *pomonella* (L.) is very small in Maine [*cf. R.A.E.*, A **3** 717], nearly 98 per cent. of 387 adults collected at bait in 1957 being of the first generation, and good control on apple is given by sprays of 3 lb. lead arsenate or of 2 lb. lead arsenate with 2 lb. 50 per cent. wettable DDT per 100 U.S. gal. These sprays were compared with others of more recent materials against a heavy infestation in 1957. A calyx and five cover sprays were applied to run-off on 4th and 17th June, 2nd, 13th and 25th July and 6th August (the last application being incomplete), and counts of larvae and (in brackets) superficial injuries per 100 fruits showed 1 (3·2) for 2 lb. 50 per cent. wettable Sevin [1-naphthyl N-methylcarbamate], 1·8 (9·2) for 2 lb. each of lead arsenate and 25 per cent. wettable malathion, 2·1 (4·2) for 2 lb. 25 per cent. wettable Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate], 2·8 (3·2) for 2 lb. 50 per cent. wettable methoxy-DDT (methoxychlor), 4·1 (7·4) for 2 lb. 50 per cent. wettable DDT, 5 (10·6) for 3 lb. lead arsenate, 4·9 (8·9) for 2 lb. lead arsenate with 2 lb. 50 per cent. wettable DDT, 6·2 (7·2) for 2 lb. 25 per cent. wettable ethion [O,O,O′,O′-tetraethyl S,S′-methylene bisphosphorodithioate], 19·8 (14·8) for 2 lb. 50 per cent. wettable DDD and 26·6 (7·7) for 2 lb. 50 per cent. wettable Perthane [1,1-di(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] per 100 U.S. gal., as compared with 50 (6·8) for no treatment. In spite of the poor control given by DDT, it is considered doubtful whether the moth has developed any resistance to it.

Dick (J.) & Johnson (N. E.). **Carabid Beetles damage Douglas-fir Seed.**—*J. econ. Ent.* **51** no. 4 pp. 542–544, 2 figs., 7 refs. Menasha, Wis., 1958.

Harpalus cautus Dej. was recently found associated with damaged seeds of Douglas fir [*Pseudotsuga menziesii*] that had been put under bark or wood

chips to protect them from rodents in cut-over forest in western Washington. The Carabid readily fed on seeds of this tree and on other vegetable materials in the laboratory and caused damage identical with that observed in the field. Limited tests in June 1957 indicated that injury was not great, occurring in less than 2 per cent. of seeds exposed for ten days. Of other Carabids tested, *Pterostichus vulgaris* (L.) also fed readily on Douglas-fir seeds.

Barnes (M. M.). **Technique for testing Insecticide Deposits with newly hatched Codling Moth Larvae.**—*J. econ. Ent.* **51** no. 4 pp. 547–549, 1 fig., 4 refs. Menasha, Wis., 1958.

The author describes a method of confining newly hatched larvae of *Cydia* (*Carpocapsa*) *pomonella* (L.) on apples for tests of insecticide deposits. The fruits are washed in trisodium-phosphate solution, rinsed and allowed to dry, and then sprayed on a turntable. Cells consisting of ¾-inch lengths of aluminium tubing, one inch in diameter, are dipped in wax and affixed to the cheeks of the apples, six to each fruit, and single eggs or newly hatched larvae, obtained from a continuous culture [*cf. R.A.E.*, A **40** 170] are placed on their inner walls. The cells are closed with squares of broadcloth, held in place by cork rings, or ringed round the top with an adhesive if fumigation effects are to be avoided, and the apples are maintained at a constant temperature of 26°C. [78·8°F.] and 85–90 per cent. relative humidity, to favour hatching and entry into the fruits; there was usually less than 10 per cent. mortality of eggs.

The results of tests on different days with a standard laboratory strain of *C. pomonella* and a DDT wettable-powder spray applied at about the LD50 are given to show the reproducibility of the results obtained, and it is pointed out that the method prevents loss of larvae and entry into the fruit through superficial injuries caused by other larvae, assesses the deposit where it is least variable and gives fairly constant results with the use of relatively few insects.

Schread (J. C.). **Control of Iris Borer with Phosphate Insecticides.**—*J. econ. Ent.* **51** no. 4 pp. 549–550, 8 refs. Menasha, Wis., 1958.

The larvae of *Macronoctua onusta* Grote have proved difficult to control on iris while they are in the folds of the leaves and in the lower parts of the fans and flower stems [*cf. R.A.E.*, A **24** 66], and tests were therefore carried out in Connecticut in 1957. On 22nd May, when the larvae had just hatched and there was 63·6 per cent. infestation, both sides of the plants were sprayed with 1:400 and 1:800 dilutions of emulsion concentrates containing 95 per cent. Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate], 26·5 per cent. Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] or 42 per cent. Dibrom (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate), with Triton B-1956 at 1:800, and examination of the leaves and stems on 27th May showed that the higher concentrations had killed 100, 74·4 and 88·8 and the lower 90·9, 38·8 and 60 per cent. of the larvae, respectively.

On 8th July, when the larvae were about half grown and examination of 12 plants revealed 14 at or near the bases and none in the rhizomes, the first two concentrates and one containing 4 lb. schradan per U.S. gal. diluted 1:800 and (except for the last) 1:1,600 were applied in the same way. Examination of leaves, stems and rhizomes on 12th July showed that Phosdrin had given complete kill at both concentrations, and the other materials poor results.

Frost (S. W.). **Insects attracted to Light Traps placed at different Heights.** —*J. econ. Ent.* **51** no. 4 pp. 550–551, 3 refs. Menasha, Wis., 1958.

In tests carried out on 21 nights in May and June at State College, Pennsylvania, with sets of Pennsylvania light-traps equipped with 15-watt ultraviolet fluorescent lamps [*cf. R.A.E.*, A **46** 223] hung one above the other at heights of about 2·5–5, 7–8 and 11 ft. above ground, where foliage partly shielded the two lower ones, and in a similar test for eight nights in June near the town, with traps at heights of about 6, 10·5 and 14·5 ft. in an area unobstructed by foliage, most insects were taken at the lower levels. The smaller insects preferred these, whereas the larger ones were more evenly distributed. Aphids were captured most readily in the presence of foliage.

Tippins (H. H.). **Control of Citrus Whitefly on Gardenia.**—*J. econ. Ent.* **51** no. 4 pp. 552–553, 6 refs. Menasha, Wis., 1958.

Dialeurodes citri (Ril. & How.) is the most injurious insect attacking Cape jasmine (*Gardenia jasminoides*) in Georgia, where infestation is usually low in spring but serious in late summer, causing the development of sooty mould over whole plants by September. Investigations on control of the Aleyrodid were carried out in September and November 1957 with six-inch plants growing in pots in an unheated building, and good control was given by granules containing Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] or Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate], applied to the soil and watered in, by oil emulsion and by emulsion sprays containing demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide], or malathion. Temperatures below freezing point were recorded on 12 days during the November tests, and the malathion and demeton treatments significantly reduced plant damage due to cold.

Wood jr. (E. A.). **A Hymenopterous Parasite new to Oklahoma.**—*J. econ. Ent.* **51** no. 4 p. 553, 1 fig., 2 refs. Menasha, Wis., 1958.

Aphelinus nigritus How., which was known to occur in other parts of the United States, was found in the autumn of 1956 parasitising *Toxoptera graminum* (Rond.) on wheat in a greenhouse in Oklahoma. In cage tests on its host range, it afforded nearly 100 per cent. parasitism of *T. graminum*, *Rhopalosiphum fitchii* (Sand.) and *Aphis* (*R.*) *maidis* Fitch and about 10 per cent. parasitism of *Macrosiphum avenae* (F.) (*granarium* (Kby.)), but did not attack *Brevicoryne brassicae* (L.) or *Therioaphis maculata* (Buckt.). The parasite was released in the field, but was not recovered, possibly owing to insufficient host populations. Before the appearance of this species, which attacked all stages of its hosts at temperatures down to 42°F., the most effective parasite of *T. graminum* in Oklahoma was *Aphidius testaceipes* (Cress.), which attacks only the later instars and is active only at temperatures above 56°F.

Brett (C. H.) & Brubaker (R. W.). **Tests comparing eight Insecticides for Control of the Mexican Bean Beetle.**—*J. econ. Ent.* **51** no. 4 pp. 553–554, 2 refs. Menasha, Wis., 1958.

Further tests of insecticides for the control of *Epilachna varivestis* Muls.

on beans were carried out in the mountains of North Carolina and at Norfolk, Virginia, in 1956–57 [*cf. R.A.E.*, A **44** 174, etc.]. Dusts were applied at 25–30 lb. per acre, and control was measured by population counts or by estimation of the degree of defoliation. In North Carolina, 1 per cent. rotenone was less effective than 3 per cent. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate], 5 per cent. Hercules AC-528 [2,3-p-dioxane S,S-bis(O,O-diethyl) phosphorodithioate] or Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate], 4 per cent. malathion or 2 per cent. Sevin [1-naphthyl N-methylcarbamate] in 1956 and than 4 per cent. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], malathion or Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] or 1 per cent. Sevin in 1957, whereas in Virginia, Dipterex and Chlorthion were less effective than the other materials in 1956 and there was no significant difference between treatments in 1957.

In laboratory tests in 1956, adults collected in North Carolina were confined in jars, treated with each dust tested in that year and removed after ten minutes to another jar containing untreated fresh bean plants. The results showed that 1 per cent. rotenone or AC-528 gave much lower mortality than any other dust after 4–8 hours and 42 and 74 per cent. mortality, respectively, after 24 hours, when the other materials gave at least 90 per cent. kill. It is concluded that *E. variveslis* still shows a definite resistance to rotenone in the mountains of North Carolina.

Dickason (E. A.), Leach (C. M.) & Gross (A. E.). **Control of the Clover Root Curculio on Alsike Clover.**—*J. econ. Ent.* **51** no. 4 pp. 554–555, 2 refs. Menasha, Wis., 1958.

Sitona hispidulus (F.) is thought to be the main cause of the decline in seed yield of alsike clover (*Trifolium hybridum*) in Oregon, because of its effect on plant vigour and stand. Larvae damage the root system by feeding on root nodules and small secondary roots and gnawing deep cavities in the tap root and possibly encourage invasion by fungi; leaf injury by the adults in early spring is of minor importance. Applications of 1 lb. DDT per acre in early spring control the adults and reduce root injury, but large numbers of roots are often injured by larvae hatching from eggs laid during mild weather in autumn, winter or early spring or from eggs laid in late spring by adults migrating into treated fields.

In an attempt to control the larvae as they moved through the soil to the roots, 4 lb. heptachlor per acre in emulsion concentrate was disked into the soil in the spring of 1955, after which oats were sown. Alsike clover was drilled into the oat stubble in late summer, and the roots were examined for insect injury in the autumn of 1956 and for insect injury and incidence of disease in the autumn of 1957. Seed yields could not be determined because of lack of uniformity of stand. The treatment reduced the percentage of damaged plants from 86 to 3 in 1956 and from 98 to 38 in 1957; there was little root rot, with no marked difference in incidence or severity in treated and untreated ground. The use of soil insecticides is considered a promising method of protecting the roots from *Sitona*.

Milliron (H. E.). **Economic Importance and Control of the Loblolly Mealybug, *Dysmicoccus obesus* Lob.**—*J. econ. Ent.* **51** no. 4 pp. 555–556, 2 figs. Menasha, Wis., 1958.

Heavy infestation by *Dysmicoccus obesus* (Lobdell) was found on 12 of

36 trees in an ornamental plantation of 15-year-old loblolly pines (*Pinus taeda*) in New Castle County, Delaware, in late July 1956. An extended search of natural stands in the south of the State revealed no other infestation. The mealybug was confined to the main trunk from ground level to a height of 4 ft. and caused a spindly appearance, sparse foliage, reduction in height and poor colour. Observations in the summer and autumn of 1956 showed that ants of at least two species were common on the infested trees; they were rarely observed on uninfested ones. Numerous mealybugs in the first instar were active and feeding in protected positions below the bark scales in mid-March 1957, and it is concluded that winter was passed above ground in this or the egg stage. A spray of two tablespoonfuls 55 per cent. malathion emulsion concentrate per U.S. gal. per tree on 31st March 1957, applied with special attention to the lower trunk, apparently gave complete control, no living insects being found in several examinations from 7th April onwards, and no phytotoxic effect was noted.

Smith (R. H.). **Additional Host Records for two Bostrichid Powder-post Beetles.**—*J. econ. Ent.* **51** no. 4 p. 556, 3 refs. Menasha, Wis., 1958.

Scobicia declivis (Lec.), a native pest of seasoned hardwoods, was found attacking mahogany lumber, possibly of the genus *Shorea*, introduced from the Philippines as logs and sawn and stored for seasoning in El Dorado County, California, in the spring of 1956. No attacks were noted in summer, and damage was confined to the sapwood. As the Sierra foothills might be a continuous source of infestation and it was possible that reproduction might occur in mahogany, though none was seen, the stacks were sprayed with an emulsified solution of 0·25 per cent. γ BHC; subsequent examination revealed no brood development and no new attacks.

In 1949, living larvae and adults of *Heterobostrychus aequalis* (Waterh.), a pest of considerable importance in the Philippines, were found in the sapwood of hickory (*Carya* sp.) forming sections of army cots returned from there to the United States. Although it was doubtful whether the insect could reproduce in the wood in the latter country, the cots were fumigated.

Snapp (O. I.). **Trunk Sprays for Control of the Peach Tree Borer.**—*J. econ. Ent.* **51** no. 4 pp. 557–558, 2 refs. Menasha, Wis., 1958.

In further tests in 1951–56 on the control of *Aegeria* (*Sanninoidea*) *exitiosa* Say on peach in Georgia [*cf. R.A.E.*, A **39** 13; **40** 354], sprays containing DDT, BHC or parathion were applied at monthly intervals to the trunks and the lower parts of the large branches, with a pressure sprayer, three times from 15th July to trees 2–3 years old in 1955 and four times from about 1st August on trees 2–8 years old in other years and 4–5 years old in 1955. The results were compared with those given by fumigation with ethylene-dichloride emulsion, which was poured round the base of the trunks on about 23rd October and covered with soil. Examination in the following spring showed that trunk sprays of 2 lb. 15 per cent. parathion, 4·8 lb. 10 per cent. γ BHC and 5·3 lb. 75 per cent. DDT, or similar quantities of the last two in other formulations, per 100 U.S. gal. were very effective against light infestations, but not consistently so when there were five or more larvae per tree. Owing to the long oviposition period in this latitude, where eggs are laid as early as 25th April and hatch as late as 7th December, the application of 3–4 sprays per season is apparently insufficient. Autumn treatment with ethylene dichloride gave very good control, regardless of the degree of infestation.

Chamberlin (F. S.) & Dutky (S. R.). **Tests of Pathogens for the Control of Tobacco Insects.**—*J. econ. Ent.* **51** no. 4 p. 560. Menasha, Wis., 1958.

A fungus, *Beauveria* (*Spicaria*) *rileyi*, a polyhedrosis virus from *Heliothis* sp., a parasitic bacterium carried by the nematode DD-136 and several spore-forming bacteria were tested for the control of larvae of *Heliothis virescens* (F.) and *Protoparce sexta* (Joh.) on tobacco in North Carolina in 1955–56. Relatively small numbers of *H. zea* (Boddie) and *P. quinquemaculata* (Haw.) were also present.

In insectary tests on small plants or suckers, relatively high concentrations of *B. rileyi* applied to *Protoparce* larvae in the second or third instars by means of a brush or as sprays caused no mortality over a considerable range of temperature and relative humidity, and the polyhedrosis virus did not affect either species of this genus, whereas cultures of two bacteria (DD-133-2 and DD-133-6) caused 70–80 per cent. mortality of *H. virescens* in 4–5 days and 93–100 per cent. mortality of *Protoparce* in the second or third instar within three days. The parasitic nematode and its associated bacterium caused only 30 per cent. mortality of *Protoparce* at temperatures of 47–96°F., but 50 per cent. at 74–77° and 66 and 100 per cent. in 24 and 48 hours, respectively, on moist tobacco leaves kept at a nearly constant temperature of 76°F. Similar results were obtained against *H. virescens*.

In field tests, in which tobacco plants infested by *H. virescens* were sprayed with the pathogens in water suspension, the nematode with its bacterium reduced larval populations by 80–85 per cent. in 3–4 days when applied at 50,000 per plant to wet foliage at a time of high relative humidity and daily maximum temperatures of about 87°F., but caused little further reduction. There was little or no control when the leaves were dry and the temperature often exceeded 90°F. The virus, applied at 487·5 million polyhedra per plant, showed a slow effect under a wide range of temperatures and humidities, but caused complete mortality in 13 days. Severe feeding damage continued for ten days after the virus application, whereas control within 2–4 days is considered essential on tobacco, but this rate of action might be satisfactory on other crops. *Beauveria rileyi*, applied at 15,000 million spores per plant, and the bacteria, at 940 million spores per plant, gave inadequate control.

Fisk (F. W.). **Toxicity of BHC in Milk to House Flies as related to Butter Fat Content of the Milk.**—*J. econ. Ent.* **51** no. 4 pp. 560–561, 6 refs. Menasha, Wis., 1958.

Two groups of lactating cows were stanchioned for 50 days and restricted to diets to which enough technical BHC (40 per cent. γ isomer) was added to provide 0, 1, 5, 25 and 125 parts total BHC per million. They were then given access to pasture and received no more BHC. Milk samples were taken weekly during the 50-day period and thereafter so long as available and positive for BHC by chemical analysis, and many of them were tested by bioassay with house-flies [*Musca domestica* L.] by the method of Sun & Sun [*R.A.E.*, A **42** 283]. After the samples had been homogenised, all except those from cows receiving BHC at the highest rate were fortified with 0·8 p.p.m. γ BHC as lindane before being tested by bioassay. The total BHC excreted in the milk as calculated from the results of these tests reached a maximum of 5 p.p.m. in the milk of cows that had received the highest rate, whereas chemical assay showed it to be 10 p.p.m. In general, results by bioassay were lower than by chemical assay, except in some instances in which recovery by chemical assay was very low. BHC was also

detectable by chemical assay longer than by bioassay. This was judged to be due in part to the more rapid excretion of γ BHC than of the other isomers. As fly mortalities varied with the breed of cow, comparative tests were made with milk samples varying in butterfat content and in non-fat solids. With about 9 per cent. non-fat solids, the estimated LC50's of γ BHC as lindane in p.p.m. were 0·34, 0·64, 0·93 and 1·4 when the percentage of butterfat was 0, 2·5, 4·8 and 6·5, respectively. With 3·8 per cent. butterfat and 9, 12, 15 and 17 per cent. non-fat solids, the estimated LC50's were 0·98, 1·15, 1·18 and 1·25, respectively.

The nature of the action of butterfat on toxicity of γ BHC is discussed. As the interbifid spaces on the house-fly proboscis measure 3–4 μ and fat particles in hand-homogenised milk measure 2 μ, it would appear that the flies cannot avoid ingesting butterfat particles in such milk, and it was experimentally confirmed that they do in fact ingest them, though they failed to digest much of the fat. This suggests that the reduced toxicity of γ BHC in the presence of butterfat is due to its reduced chemical potential under these conditions. That is, for a given amount of γ BHC, the greater the amount of solvent butterfat the lower will be the percentage saturation of the latter and the less the tendency of the chemical to diffuse out of the fat and into the haemocoele and nerve tissues of the insect. Part of the fat will pass through the alimentary canal unchanged, retaining some of its dissolved γ BHC intact. The reduced toxicity of γ BHC in the presence of butterfat presents no objection to the use of the bioassay method, except as sensitivity is reduced, so long as milk of the same butterfat content is used for plotting the standard regression line.

Butler jr. (G. D.). **Tachinid Flies reared from Lepidopterous Larvae in Arizona, 1957.**—*J. econ. Ent.* **51** no. 4 pp. 561–562, 2 refs. Menasha, Wis., 1958.

A list is given of 10 Tachinid parasites reared from Lepidopterous larvae collected from crops or desert weeds in Arizona in 1957, with information on their hosts and the plants and, sometimes, localities from which they were taken. *Achaetoneura archippivora* (Will.) was much the most abundant in the crop areas and had the widest host range, being reared from *Laphygma exigua* (Hb.), *L. frugiperda* (J. E. Smith), *Trichoplusia ni* (Hb.), *Heliothis* spp., *Colias eurytheme* Boisd., *Loxostege similalis* (Gn.), *Prodenia ornithogalli* Gn., *Vanessa cardui* (L.) and *Estigmene acraea* (Dru.). It was most abundant in summer and autumn and occurred throughout southern Arizona, but was not found in collections from the north of the State.

Arbuthnot (K. D.). **Endrin and Ryania for Control of Sugarcane Borer in Corn.**—*J. econ. Ent.* **51** no. 4 pp. 562–563, 2 refs. Menasha, Wis., 1958.

Granules containing 2·5 per cent. endrin and dusts containing 1 per cent. endrin or 40 per cent. ryania were applied at 40, 100 and 62·5 lb. per acre, respectively, for the control of *Diatraea saccharalis* (F.) on maize in Texas in the summer of 1956. Examination on 10th July of plants that received five weekly applications from 24th May, when the maize was in the late-whorl stage and 20 per cent. of the plants were infested with larvae beyond the first instar, probably of the first generation, showed that endrin about halved the percentage infested by the second generation and ryania the percentage infested by the first. Both materials reduced the numbers of

larvae, but ryania was the more effective against the first generation and endrin against the second. The endrin granules afforded the most and ryania the least protection of the ears, and the granules caused the greatest reduction in larval populations in the ears.

In a test on late-sown maize, four applications were made, beginning on 21st July, and the plants were examined on 25th September. Endrin granules caused the greatest reductions in the numbers of larvae, plants infested, joints and shanks bored and ears reduced to less than half the normal length, but increased the number of broken stems, possibly owing to the greater weight of the sound ears and stem weakness caused by drought. All treatments increased the yield, the endrin treatments doing so by 155–160 per cent. and ryania by 54 per cent. Such numerous and heavy applications could probably not be used in practice, but the great yield increases indicated the severity of the damage that can be caused by *D. saccharalis*.

Freeman (C. C.). *Liriomyza guytona*: **a new Species of Agromyzid Leaf Miner.**—*Ann. ent. Soc. Amer.* **51** no. 4 pp. 344–345, 1 fig. Washington, D.C., 1958.

Descriptions are given of the adults of both sexes of *Liriomyza guytona*, sp.n.; the larvae of this Agromyzid were found mining the leaves of tomatos, beans, crucifers and cucurbits in Lee County, Alabama, the severity of the damage increasing considerably during the growing season of 1956, and also those of cucurbits in Florida and tomatos in the Rio Grande Valley of Texas.

Dickson (R. C.), Laird jr. (E. F.) & Johnson (M. M.). **Sexuales and Eggs of the Spotted Alfalfa Aphid.**—*Ann. ent. Soc. Amer.* **51** no. 4 pp. 346–350, 5 figs., 6 refs. Washington, D.C., 1958.

Therioaphis maculata (Buckt.) is widespread in the United States. It persists throughout the year as far north as Kansas and central Utah, but dies out each winter in colder districts, which indicates that it does not produce normal winter eggs.

Populations on lucerne were sampled during the autumn and winter of 1956–57 at various places in southern California. Sexuales appeared in desert localities in the Coachella and Imperial Valleys towards the end of October, almost disappeared by the end of January, possibly owing to warm weather in the first half of that month, and were present again from mid-February to early March. The highest percentage in any field was 6·7. A similar pattern was found near Riverside, where conditions are intermediate between those of the desert and the coast, and also at a coastal locality, though the proportion remained low in the latter. Few sexuales were produced at two colder localities. Of the sexuales taken, 86·4 per cent. were apterous oviparae, 9·8 per cent. alate oviparae (an abnormal form) and the remainder males. The data indicated that they were produced in response to short day-length and low temperature. When 763 apterous oviparae were caged on lucerne between October and February only 137 eggs were laid, and none of them hatched. Of a few oviparae confined singly, one laid three eggs.

The results indicate that *T. maculata* is in effect entirely parthenogenetic, surviving the winter only where continuous feeding is possible. The development of resistance to parathion has been reported in the aphid in southern

California [*cf. R.A.E.*, A **47** 325], and, since there can be no gene recombination in a parthenogenetic species, this presumably occurred as a result of mutation and subsequent selection to produce resistant clones [*cf.* **47** 326].

Bean (J. L.). **The Use of Larvaevorid Maggot Drop in measuring Trends in Spruce Budworm Populations.**—*Ann. ent. Soc. Amer.* **51** no. 4 pp. 400–403, 2 figs. Washington, D.C., 1958.

Investigations were made in Minnesota on the possibility that populations of *Choristoneura fumiferana* (Clem.) on balsam fir (*Abies balsamea*) might be estimated from a knowledge of the percentage parasitism of the larvae by Tachinids and the numbers of Tachinid larvae falling on an area of ground beneath the trees to pupate. The latter were estimated by the use of inverted cone traps suspended beneath the crowns of study trees. The results indicated considerable variation in population between trees, with higher populations in the top third of the crown of an individual tree than lower down. Significant differences could be determined between populations in the same area in two different years and also for two areas within the same period.

Proceedings of the Tenth International Congress of Entomology, Montreal, August 17–25, 1956. Section on Stored Products Entomology.—*Proc. 10th int. Congr. Ent.* **4** pp. 3–105. Ottawa, 1958.

The following are abstracts of selected papers containing hitherto unpublished information of which the text is printed in full in this section [*cf. R.A.E.*, A **47** 317].

Barnes (D.). **The Stored Grain Insect Problem in Mexico. A Report of the Control Measures now under Study,** pp. 19–22, 1 ref. The following is based on the author's abstract. It was estimated in 1952 that about 15 per cent. of the maize, wheat and beans stored in Mexico were lost as a result of insect damage. Of the insects collected from maize and wheat, *Calandra* (*Sitophilus*) *oryzae* (L.), *C.* (*S.*) *granaria* (L.), *Sitotroga cerealella* (Ol.), *Anagasta* (*Ephestia*) *kühniella* (Zell.) and *Plodia interpunctella* (Hb.) are the most important. The principal pests of beans are *Acanthoscelides obtectus* (Say) in the central plateau and *Zabrotes subfasciatus* (Boh.) (*Spermophagus pectoralis* Sharp) in the tropical districts. DDT, methoxy-DDT (methoxychlor) and dieldrin at 50 parts per million give good control of *C. oryzae* and *C. granaria* in seed maize and wheat. Fumigants at low rates of application have given good results in grain for human consumption. A 1:4 mixture of carbon bisulphide and carbon tetrachloride applied at 85 fl. oz. per 1,000 cu. ft., with an exposure period of 24 hours, proved very effective against *C. oryzae*. Acrylon [a proprietary preparation of acrylonitrile] at 70 fl. oz. was also effective.

La Hue (D. W.). **Insect Damage to southern Corn in Storage as affected by initial Field Infestation, Methods of Storage and Moisture Content,** pp. 77–80. The following is substantially the author's abstract. Maize grown in southern Georgia is subject to field infestation by the rice weevil [*Calandra oryzae* (L.)]. It is normally stored on the farm with the husk left in place, a condition that makes insect control difficult by insecticidal means. Observations were made on insect damage to maize during storage of lots in which the initial field infestation was light, medium or heavy. Each lot of maize was stored as snapped maize, ear maize, field shelled, field shelled and cleaned, and shelled, cleaned and dried to 10 per cent. moisture content. In a second series, maize at the three levels of field infestation

was shelled, cleaned and dried to moisture contents ranging from 8 to 15 per cent. After storage for six months, uniform samples were examined to determine the percentage of kernels infested and insect abundance. In the first series, insect damage was heavy in all lots where the maize was stored as snapped, ear or field shelled. Infestation and insect damage were less in the lots that were shelled and cleaned, and least in the lots that were shelled, cleaned and dried to 10 per cent. moisture content. In all categories, insect infestation and damage were greatest in the maize that had a heavy initial field infestation. In the second series, there was a direct correlation between moisture content and insect damage. In maize with a light or medium field infestation, damage was light when storage took place at moisture contents of 8, 10 or 12 per cent. Maize with a heavy field infestation was severely damaged at moisture contents of 10 per cent. or higher.

Berck (B.). **Distribution and Persistence of Fumigant Mixtures applied to Grain,** pp. 99–103. The following is the author's abstract. Methyl bromide, ethylene dibromide, and carbon tetrachloride (MB, EB and CT) were applied both singly and in admixture to the surfaces of grain stored in commercial warehouses and in test cylinders. Chemical analyses of the individual fumigant gases made at various levels showed that EB was strongly sorbed at surface levels and that this tendency was augmented in the presence of weed seeds of high oil content, and particularly when grain of high moisture content was present. The downward diffusion of MB was much faster and greater than that of EB under similar conditions. When CT was added, significantly higher proportions of EB and MB penetrated to the bottom of 30-ft. grain piles, and caused increased mortality of test insects. A fumigant containing EB + CT showed greater insecticidal effectiveness than a spot fumigant containing EB + MB. This is explained partly by the improved downward distribution and persistence of EB when CT is present.

When an EB:MB mixture was applied to wheat the EB was rapidly sorbed within the first 16 hours, resulting in an appreciable reduction of the original EB:MB ratio. Analysis of the gases removed from the treated wheat in a desorption apparatus showed that the desorbed gas consisted almost entirely of EB.

From experimental evidence indicating preferential sorption of some of the components of fumigant mixtures, it is concluded that insecticidal concepts based on fixed chemical proportions do not apply in practice.

Rivard (I.). **A Technique for rearing Tyroglyphid Mites on Mould Cultures.** —*Canad. Ent.* **90** no. 3 pp. 146–147, 1 fig., 4 refs. Ottawa, 1958.

In the technique described, which was developed during studies on *Tyrophagus* (*Tyroglyphus*) *castellanii* (Hirst), the mites are reared in a micro-cell constructed from upper and lower strips of acrylic plastic, each about 1 × 3 × $\frac{1}{16}$ in., separated by a strip of water-permeable cellophane previously soaked in water. In the centre of each plastic strip is a hole, $\frac{1}{4}$ in. in diameter at the top and $\frac{1}{8}$ in. in diameter at the bottom in the upper strip and about $\frac{1}{16}$ in. in diameter and extending only half way through it in the lower. A microscope slide is placed over the upper strip and the whole is bound together at each end with a strip of paper held by a rubber band. Before assembling, the hollow in the lower strip is filled with a paste of powdered wheat germ mixed with water after which the cellophane, soaked in water, is laid over it. The hole in the upper strip is placed directly over that in the lower one, and spores from a mould culture are transferred to the cellophane thus exposed. The cell is kept at controlled temperature and humidity for 24 hours, after which one or two mites are placed on the mould

growth that has developed. Several generations of *T. castellanii* were reared on *Aspergillus* sp. in this way.

MacGillivray (M. E.) & Anderson (G. B.). **Development of four Species of Aphids (Homoptera) on Potato.**—*Canad. Ent.* **90** no. 3 pp. 148–155, 1 graph, 15 refs. Ottawa, 1958. **Production of apterous and alate Progeny by apterous and alate Viviparae of** *Macrosiphum solanifolii* **(Ashm.) (Homoptera: Aphididae).**—*T. c.* no. 4 pp. 241–245, 2 graphs, 16 refs.

The following is largely the authors' summary of the first paper. The maturation, reproductive and survival periods and the fecundity of four species of potato-infesting aphids, *Macrosiphum solanifolii* (Ashm.), *M.* (*Aulacorthum*) *solani* (Kalt.), *Myzus persicae* (Sulz.) and *Aphis abbreviata* Patch, were recorded for individuals reared from birth to death on excised potato leaves in the greenhouse in New Brunswick between March and October 1954. Apterae of *M. persicae* and *Macrosiphum solanifolii* developed similarly, maturing in about nine days and surviving for about 41–44, while *A. abbreviata* and *M. solani* matured in 7 and 12 and survived for about 35 and 45 days, respectively. In all species, the reproductive period was more than twice as long as the maturation period and the peak of reproduction occurred between the fifth and tenth days. Alates and apterae of *M. solanifolii* produced about equal numbers of progeny, but showed differences in the distribution of the latter during the reproductive period; furthermore, the maturation and reproductive periods were significantly longer and the post-reproductive period significantly shorter by one, two and three days, respectively, in alates than in apterae. *Myzus persicae* produced the greatest number of nymphs (a mean of 75·5 per female). During the post-reproductive period, all species appeared to feed but had a tendency to wander. Feeding during this period may have a significance in the spread of certain virus diseases of potato [*cf. R.A.E.*, A **46** 155, etc.]. It is suggested that in studies of aphids on potato the species involved and their forms, alate or apterous, should be considered individually, rather than collectively as a homogeneous population.

In the second paper, the authors state that although the four aphids were reared continuously in the greenhouse from 1953, only *Macrosiphum solanifolii* produced alates in abundance. *A. abbreviata* produced alates during April and May and from August to November each year, and *Myzus persicae* did so when the food-plants were heavily populated, but *Macrosiphum solani* produced none at all, even when severely crowded. The influence of parentage on the production of winged offspring was investigated in an experiment in which series of each species were reared on excised potato leaves under alternating periods of six hours of darkness and 18 of light [*cf.* **17** 490, etc.], between April and August 1953. Each series originated from five first-instar nymphs from a parent of known form, and these were reared throughout life on individual leaves to avoid crowding [*cf.* **45** 66]; each day, the progeny produced by the alates among them were transferred to one leaf and those by the apterae to another, on which they were reared to maturity, when their forms were recorded. The following is taken from the authors' summary of the results. Only *Macrosiphum solanifolii* produced alates, and they were generally fewer than the apterae. Apterous and alate parents produced about the same percentage of apterous offspring. Alate sister aphids produced a higher percentage of apterous progeny than did their apterous sisters. The greatest number of alate offspring was produced a few days after the greatest number of apterous offspring and did not occur as a result of crowding.

Ghouri (A. S. K.) & McFarlane (J. E.). **Observations on the Development of Crickets.**—*Canad. Ent.* **90** no. 3 pp. 158–165, 11 refs. Ottawa, 1958.

Acheta domesticus (L.) is suitable as a test insect for physiological research, and *A. configuratus* (Wlk.) and *Gryllodes sigillatus* (Wlk.) are in some respects still more so. An account is given of methods for rearing these crickets, with observations on the rate of development and fecundity. They were reared on a mixed food medium, details of which are given, and on baby rabbit pellets, and provided with moist sand for oviposition. At 28°C. [82·4°F.], the mean survival, preoviposition and oviposition periods of *A. domesticus* were 64, 10 and 35 days, respectively, and the mean number of eggs deposited was 728. The corresponding figures were 51, 8, 36 and 667 for *A. configuratus* and 61, 9, 44 and 864 for *G. sigillatus*.

Embree (D. G.). **The external Morphology of the immature Stages of the Beech Leaf Tier, *Psilocorsis faginella* (Chamb.) (Lepidoptera: Oecophoridae), with Notes on its Biology in Nova Scotia.**—*Canad. Ent.* **90** no. 3 pp. 166–174, 32 figs., 12 refs. Ottawa, 1958.

The following is virtually the author's summary. *Psilocorsis faginella* (Chamb.) is a common defoliator of American beech (*Fagus grandifolia*) in Nova Scotia. All stages, except the adult, are described. Adults appear in late July and deposit eggs, usually on the lower surfaces of the leaves. The larvae hatch in about two weeks, complete their development in five instars and by late September drop to the ground and pupate in the litter. Several Tachinid, Braconid and Ichneumonid parasites were reared from the larvae.

Perron (J. P.), Lafrance (J.) & Hudon (M.). **Timing Soil-surface Applications of Chlordane Dust against the Onion Maggot, *Hylemya antiqua* (Meig.) (Anthomyiidae: Diptera), in Onion Seedlings.**—*Canad. Ent.* **90** no. 3 pp. 176–178, 6 refs. Ottawa, 1958.

The following is virtually the authors' summary. In experiments in sandy loam soil in southern Quebec in 1951–1954, 95 per cent. control of *Hylemyia antiqua* (Mg.) in onion seedlings was obtained by applying a 5 per cent. chlordane dust on 25th May and 1st June. A third application on 8th June did not improve the protection. A single application on 1st June gave commercial control and was more satisfactory than a single application on either of the other dates.

Burnett (T.). **Effect of Host Distribution on the Reproduction of *Encarsia formosa* Gahan (Hymenoptera: Chalcidoidea).**—*Canad. Ent.* **90** no. 3 pp. 179–191, 5 figs., 7 refs. Ottawa, 1958. **Effect of Area of Search on Reproduction of *Encarsia formosa* Gahan (Hymenoptera: Chalcidoidea).**—*T. c.* no. 4 pp. 225–229, 2 graphs, 2 refs.

The factors that influence the ability of insect parasites to find their hosts [*cf. R.A.E.*, A **38** 397, etc.] were investigated in tests with *Encarsia formosa* Gah. attacking *Trialeurodes vaporariorum* (Westw.). In the experiments described in the first paper, batches of 4, 16, 36, 64 and 100 laboratory-reared hosts in the early pupal stage were introduced into cages 5 × 5 in. in area and less than 1 in. in height, on the floor of which they were distributed on a sheet of cellophane on moist green blotting paper either uniformly or in one central or four corner groups. A batch of 20 female parasites was

introduced into each cage, which was then inverted, and the position of each host and the number of eggs that it contained were recorded after 18 hours, during which the cages were kept at 24°C. [75·2°F.] and 80 per cent. relative humidity. The efficiency of the parasite was greater when the hosts were grouped than when they were evenly distributed, but the number of hosts attacked was significantly greater only at the three highest host densities and the number of eggs deposited only at the two highest. The numbers of hosts attacked and of eggs deposited were both approximately proportional to the number of hosts exposed. Superparasitism was most frequent among hosts in groups and at the highest host densities. In further tests, the number of hosts was kept constant at 36 per cage and the number of parasites varied from 2 to 64. In this case, neither the number of hosts attacked nor, in general, that of eggs deposited was significantly affected by the type of host distribution, and the parasites tended to find hosts in proportion to the natural logarithm of parasite density. Superparasitism increased with parasite density and was slightly higher when the hosts were in groups. Some evidence that all hosts were not equally acceptable to the parasite females was provided by a relatively slight increase in the total number of eggs laid when host density was increased from 64 to 100. In both series of experiments, the mean number of eggs laid per female at maximum host density was about half that normal for the parasite.

In the further experiments described in the second paper, in which a similar procedure was adopted to investigate the influence of area on host location, groups of 20 parasites searched among 4–100 hosts evenly distributed in cages 25, 100 or 200 sq. in. in area. For a given number of hosts, the numbers of hosts parasitised, parasite eggs laid and eggs per host exposed all decreased as the area increased. On any given area, the number of eggs deposited increased with host density, but the number of eggs per host and per parasitised host were usually greatest when 36 hosts were exposed. On the two larger areas, the percentage of hosts parasitised increased with host density till the latter reached 36 per cage, after which it remained fairly constant.

Smith (B. C.). **Responses to Light and Influence of Light and Temperature on Locomotion of the Crawler of the Balsam Woolly Aphid, *Adelges piceae* (Ratz.) (Homoptera: Phylloxeridae), and of Insect Predators of this Species.**—*Canad. Ent.* **90** no. 4 pp. 193–201, 3 graphs, 1 ref. Ottawa, 1958.

The influence of light and temperature on the movements of five insect predators introduced against *Chermes* (*Adelges*) *piceae* Ratz. on *Abies balsamea* [*cf. R.A.E.*, A **46** 266] and on those of the host were studied in field cages and in the laboratory in New Brunswick in 1954–55 by methods that are described. The following is almost entirely based on the author's summary of the results. In the field tests, feeding, last-instar larvae of *Aphidecta obliterata* (L.) and *Scymnus* (*Pullus*) *impexus* Muls. confined on bark heavily infested by *C. piceae* covered greater areas than those of *Cremifania nigrocellulata* Czerny and *Laricobius erichsonii* Rosenh.; the numbers in movement and the distances traversed were not greatly influenced by air temperature or light intensity. None of the predators preferred those sections of bark on which the prey was most numerous, and all fed at night. Adults of *C. nigrocellulata* and *Leucopis* (*Neoleucopis*) *obscura* Hal. made short flights to areas of sunlight at temperatures of 15–25°C. [59–77°F.], whereas adults of *A. obliterata*, *Laricobius erichsonii* and *S. impexus* seldom flew and were mostly either stationary or crawling on the bark; these three

species crawled at temperatures ranging from 8°C. [46·4°F.] to 25°C. On the basis of the field and laboratory observations, the order of decreasing tolerance to light of the five species is probably *Leucopis obscura*, *C. nigrocellulata*, *A. obliterata*, *S. impexus* and *Laricobius erichsonii*. In the laboratory, adults, except of *A. obliterata*, were active at temperatures of approximately 3–22°C. [37·4–71·6°F.]. Among the other four species, the frequency of stopping was greater for all except *Leucopis obscura* at high light intensity than at low, and the frequency with which they crossed their own tracks was greater at low light intensity than at high. The rate at which crawlers of *Chermes piceae* moved was greater at high light intensity than at low and increased with temperature.

Morgan (C. V. G.) & Anderson (N. H.). **Techniques for biological Studies of Tetranychid Mites, especially** *Bryobia arborea* **M. & A. and** *B. praetiosa* **Koch (Acarina: Tetranychidae).**—*Canad. Ent.* **90** no. 4 pp. 212–215, 2 figs., 3 refs. Ottawa, 1958.

The techniques described were developed in British Columbia for studies on the populations of Tetranychid mites in orchards, notably of the species recognised as *Bryobia praetiosa* Koch, which feeds on herbaceous plants, and the fruit-tree form distinguished from it and named *B. arborea* Morgan & Anderson [*R.A.E.*, A **47** 118]. A convenient trap for sampling overwintering and ovipositing adults of *B. practiosa* consists of eight $\frac{1}{4}$-in. plywood boards, about 1 ft. square, with shallow grooves cut in one surface and held together in two groups of four, with the grooved sides innermost, by means of a carriage bolt projecting on each side of a wooden stake inserted into the soil so that the lower edges of the boards are a few inches above the ground; a horizontal board at the top of the stake keeps the trap dry. Winter eggs of *Petrobia latens* (Müller) were also deposited in these traps.

For determination of the period and rate of hatching of eggs of *B. arborea* and *Panonychus* (*Metatetranychus*) *ulmi* (Koch), which are laid on the lower surfaces of fruit spurs and twigs, a piece of twig, about 1 in. long, bearing eggs is stapled to an index card round the edge of which a barrier of Deadline adhesive is spread. The newly hatched larvae are readily visible on the card and can be removed from it or from the adhesive. Deadline adhesive is not appreciably affected by rain, but it spreads in hot weather and if applied too thickly may affect the development of the eggs. A similar technique can be used for eggs of *B. praetiosa* on wood cut from the trap, but not on bark scales, which are too brittle. The newly hatched larvae of this species are positively geotropic, and if the card is placed vertically, a small cardboard shelf coated with the adhesive can be attached below the plywood to trap larvae moving downwards.

An accurate sampling technique for estimating summer numbers of *B. practiosa* was not developed, but population trends can be observed by means of counts of the active stages made from samples tapped from the food-plants and passed through a mite-brushing machine [*cf.* **45** 149] and of the immobile stages made at intervals in a specific section of the plywood trap. Winter populations are determined from counts made in the same section of the trap on successive dates.

Individual mites can be conveniently reared in isolation by a modification of Siegler's leaf-disk technique [**36** 343], in which a leaf from which the petiole has been removed is pressed on to a pad of absorbent cotton kept sufficiently moist to provide a thin film of water round the edge of the leaf. The advantages of this over the floating detached-leaf method of Rodriguez [**42** 101] are that less frequent watering is needed and that the leaf is more easily examined microscopically and less liable to be flooded when the dish

containing it is moved or the leaf pressed during handling of the mites. The technique is satisfactory for summer forms of *P. ulmi* and species of *Tetranychus* and *Eotetranychus*.

Finlayson (L. R.) & Finlayson (T.). **Parasitism of the European Pine Sawfly, *Neodiprion sertifer* (Geoff.) (Hymenoptera: Diprionidae), in southwestern Ontario.**—*Canad. Ent.* **90** no. 4 pp. 223–225. Ottawa, 1958.

Of a total of 8,326 cocoons of *Neodiprion sertifer* (Geoffr.) collected in 1941, 1943, 1946, 1947 and 1949 in southern Ontario, mostly in the neighbourhood of Sarnia, adult sawflies emerged from 68 per cent. and parasites from 12 per cent.; dead larvae and pupae of *N. sertifer* were found in 16 per cent. and dead parasite larvae in 4 per cent. The percentage parasitism in the five years amounted to 9, 6·2, 19·3, 20·6 and 46·9, respectively. The parasites comprised 11 Hymenoptera and three Diptera, the former including *Aptesis basizona* (Grav.), *Dahlbominus fuscipennis* (Zett.) and *Exenterus abruptorius* (Thnb.), which were introduced from Europe and released in the Sarnia area in 1941–47. *E. abruptorius* has not hitherto been recorded as established in Canada. *A. indistincta* (Prov.), a native parasite of which releases were made in 1942 from a stock originating from New Brunswick, was also represented.

Neilson (W. T. A.). **Notes on Life-histories of Sawflies (Hymenoptera: Tenthredinidae) common in Low-bush Blueberry Fields in New Brunswick.**—*Canad. Ent.* **90** no. 4 pp. 229–234, 3 figs., 4 refs. Ottawa, 1958.

Keys are given to the eggs and full-fed larvae of six sawflies that are common in fields of low-bush blueberry [*Vaccinium*] in New Brunswick, together with notes on their bionomics. Of the three that feed on blueberry, *Neopareophora litura* (Klug) and *Pristiphora idiota* (Nort.) produce only one generation a year, but *Pristiphora* sp. produces a partial second generation or even a second and partial third. The larvae of these species all overwinter in silken cocoons at depths of 2–3 in. in the litter. They pupate in the following year, and the adults emerge 1–2 weeks later. Adults of *N. litura* appeared from early to late May, those of *Pristiphora* sp. from mid-May to early June and those of *P. idiota* from mid-August to early September; adults of the partial second, complete second and partial third generation of *Pristiphora* sp. appeared from early July to late August, in July, and in late August, respectively. All three species are parthenogenetic, males are scarce, and mating was not observed. The maximum numbers of eggs laid by females of *N. litura*, *P. idiota* and *Pristiphora* sp. were 32, 42 and 66, respectively. Most eggs were laid within four days of emergence. In the field, there was usually only one per bud or leaf. The larvae hatched in 5–11 days and fed at the edges of the leaves, except for the first-instar larva of *N. litura*, which fed within the bud and consumed all or most of it. Feeding continued for about four weeks in this species and for 5–6 weeks in the other two. When full-fed, the larvae entered the soil, where they remained in diapause in their cocoons for about ten months or, when there was a second or third generation, for between two and eight weeks. Five Ichneumonid parasites were reared from *N. litura*, and one, *Cteniscus clypeatus* Cress., from *Pristiphora* sp.; the commonest of the former were *Polyblastus pedalis* (Cress.) and *Mesoleius* sp. Eggs of *P. pedalis* were laid singly on the last-instar larva during the first three weeks of June and

hatched in the following spring, when the larvae consumed the host larvae, pupated within their cocoons, and gave rise to adults in early June. The period spent within the host cocoon usually lasted 333–365 days, but occasionally only 35.

Burnett (T.). **Dispersal of an Insect Parasite over a small Plot.**—*Canad. Ent.* **90** no. 5 pp. 279–283, 1 graph, 4 refs. Ottawa, 1958.

The relation between parasitism by *Dahlbominus fuscipennis* (Zett.) and host density [*cf. R.A.E.*, A **42** 245; **44** 402] was further investigated in Ontario in an experimental plot, 24 ft. square, with vegetation in which red pine [*Pinus resinosa*] predominated but some oak, poplar, birch, ferns and grasses were included. Parasite females, 24–48 hours old, were released at the centre of the plot, and 32 wire-mesh trays, each with a layer of damp moss with cocoons containing paralysed larvae of *Neodiprion leconteï* (Fitch) evenly spaced over it and covered with wire screening, were distributed at 16 points (arranged in a 4 × 4 pattern) 24 hours later. In each experiment, the number of cocoons per tray was constant throughout the plot for one of the two trays at each point (termed the control tray), but four different numbers were used on the other. The numbers of hosts parasitised and of parasite eggs deposited were determined by dissecting the host cocoons 72 hours after exposure. The experiments were continued throughout the summer and included variations in parasite density and tray area, but the results of all but three were discarded because of erratic and very low parasitism, due to high temperature, excessive rain and destruction by birds. In these three experiments, respectively, the number of parasites released was 20,000, 20,000 and 14,000, the area of each tray was 50, 144 and 144 sq. in., and the number of cocoons per tray was 49, 16 and 16 for the control trays and 9–121, 4–81 and 4–81 for the test trays. In the latter, the numbers of hosts parasitised and (except in the first experiment) of eggs deposited per tray increased with the number of hosts exposed, and there was a slight tendency in the control trays in the last two experiments for the hosts nearest the point at which the parasites were released to be the most heavily parasitised and for parasitism to be slightly higher in one direction from that point than in others, though hosts at all sites were attacked. Control cocoons were often more heavily parasitised when next to hosts at low than at high densities. The parasites evidently dispersed very slowly over the plot, even in the absence of hosts, and became distributed throughout it, despite the heterogeneity of the environment; they were attracted to the higher host densities over an area of 1 or 2 sq. ft. The observed increase in the number of hosts parasitised and a calculated decrease in percentage parasitism, both with increased host density [*cf.* **43** 171], were shown by statistical analysis to be significant in the first experiment and when the data from all three experiments were combined. The results obtained confirmed those of the earlier laboratory tests [**42** 245].

Blakeley (P. E.), Jacobson (L. A.) & Forster (R. R.). **Rearing the Army Cutworm, *Chorizagrotis auxiliaris* (Grote) (Lepidoptera: Noctuidae), in the Laboratory.**—*Canad. Ent.* **90** no. 5 pp. 301–302, 2 refs. Ottawa, 1958.

Cutworms are excellent test insects for investigations on toxicology, physiology and behaviour, but many require specialised rearing techniques. Methods devised during an outbreak in southern Alberta in 1955 for rearing

Chorizagrotis auxiliaris (Grote), which undergoes a period of apparent aestivation during July and August, are described. Males and females that have emerged in the laboratory are transferred in groups of 15–25 to oviposition jars, 6 in. in diameter and 8 in. high, having a circular piece of window screen in the cover and containing sifted soil to a depth of ½ in., pleated paper towelling to provide a resting surface, and a 10 per cent. solution of honey in a feeding apparatus [*cf. R.A.E.*, A **46** 316]. The jars are kept at 15°C. [59°F.] for about 30 days and are then transferred to room temperature or a constant temperature of 25°C. [77°F.], after which the females begin oviposition within about ten days. Eggs are collected daily by sifting the soil through a 50-mesh screen and incubated for about five days at 25°C., after which they are ready to hatch or can be stored for up to 30 days at 0°C. [32°F.]. When larvae are required, incubated eggs are placed on moistened filter paper in a stacking preparation dish, 4 in. in diameter and 2 in. high, containing small leaves of dandelion or lettuce. The dishes are sealed with Parafilm until the first moult and are then covered with a loose lid; they can accommodate 200 third-instar larvae each, but larger vessels can be used if desired. Large quantities of dandelion leaves are placed on sand in the dishes as food; more uniformly large larvae developed on this diet than on lettuce, the high moisture content of which favoured disease organisms, or other vegetation. At temperatures above 20°C. [68°F.], fresh food is required daily. When they reach the prepupal stage, the larvae are transferred singly to petri dishes, in which they pupate. The pupal stage, during which the sexes are segregated, lasted 20–25 days at room temperatures, and at about 25°C. emergence took place 50–60 days after hatching. The adults can be stored in the oviposition jars at 10°C. [50°F.] for 100 days or more with little mortality if provided with food and a resting surface (paper towelling).

Fox (C. J. S.) & Jaques (R. P.). **Note on the Green-muscardine Fungus, *Metarrhizium anisopliae* (Metch.) Sor., as a Control for Wireworms.**— *Canad. Ent.* **90** no. 5 pp. 314–315, 4 refs. Ottawa, 1958.

Metarrhizium anisopliae was prevalent from 1951 in a moderately dense population of larvae of *Agriotes obscurus* (L.) at one place in Nova Scotia and considerably less so in a very dense population of *A. sputator* (L.) at another, where the annual rainfall was lower and coastal fog less frequent. Both these wireworms are introduced species [*cf. R.A.E.*, A **43** 117]. As soil applications of insecticides gave only temporary control [*cf.* **47** 318], the possibility of increasing fungus incidence by the dissemination of spores was investigated. *M. anisopliae* was readily cultured on maltose agar in the laboratory, and when ten larvae were confined in 500 g. soil inoculated with 50 ml. of a suspension containing at least 750,000 spores per ml., one or more of the larvae in almost every group developed the disease, more doing so at 70 than at 50 or 60°F. Continual subculturing on the agar caused the virulence of the fungus to decline, and fresh isolates were therefore obtained frequently in subsequent work from naturally infested larvae. In further tests, larvae of *A. sputator* were confined individually at about 70°F. on various media, to each of which was added 1 ml. sterile water containing 500,000–700,000 spores and thereafter water at frequent intervals. The percentage mortality on sterilised vermiculite, soil, filter paper and sand over 50–60 days amounted to only 8, 3, 10 and 17, respectively, and was not increased when the abrasiveness of the soil or vermiculite was increased by the addition of glass spicules or when the body wall of the larva was injured with a pin. Crushed healthy larvae streaked on agar heavily seeded with spores, in an investigation of the possibility that a component of the body

wall could inhibit fungus growth, had no effect on it. In field experiments at the two places where the fungus occurred naturally, bran, soil or peat moss in which the fungus had been cultured was incorporated by means of a rotary cultivator into one half of each of a number of plots of about 30 sq. yd. in hay fields at rates of 1·5, 2 and 1·5 lb. per half-plot, respectively, in August 1954 against *A. sputator* and in May 1955 against *A. obscurus*. There was no evidence over 15 months that the incidence of the disease was increased. Laboratory tests in which autoclaved soil was heavily inoculated with spores indicated that the limiting factor was not the quantity of fungus available, but an environmental condition.

Ghent (A. W.). **Studies of the Feeding Orientation of the Jack Pine Sawfly,** *Neodiprion pratti banksianae* **Roh.**—*Canad. J. Zool.* **36** no. 2 pp. 175–183, 1 pl., 2 figs., 2 refs. Ottawa, 1958.

The following is almost entirely based on the author's summary of this account of laboratory observations on larvae of *Neodiprion pratti banksianae* Rohw. feeding on needles of jack pine (*Pinus banksiana*). The heads of feeding larvae were consistently oriented towards the needle tips. This orientation was not obtained from the minute apically directed teeth along the edges of the needles and was found to be independent of gravity and of the flexibility of the foliage. Though light could disrupt this orientation, larvae adopted it in darkness, so that light cannot be an essential directive stimulus. The behaviour is identified as a response to the free end of the needle, and possible underlying mechanisms are discussed.

Smith (R. W.). **Parasites of nymphal and adult Grasshoppers (Orthoptera; Acrididae) in western Canada.**—*Canad. J. Zool.* **36** no. 2 pp. 217–262, 4 figs., 11 maps, 82 refs. Ottawa, 1958.

The following is based almost entirely on the author's summary. The taxonomy, distinctive features, life-histories, seasonal occurrence, incidence in different hosts and at different times, and economic significance in Canada of 22 species of Diptera and undetermined Mermithids that parasitise grasshoppers there are described. Three Chalcidoids that are parasitic on the Diptera are similarly discussed. The information is based on field collections in western Canada in 1938–53 and on laboratory studies in Ontario in 1939–55.

Begg (J. A.). **Control of the Eastern Field Wireworm,** *Limonius agonus* **(Say), in early Potatoes in Ontario by Application of Insecticides to the Soil.**—*Canad. J. Pl. Sci.* **39** no. 3 pp. 342–349, 23 refs. Ottawa, 1959.

The following is based almost entirely on the author's summary. In experiments on the control of *Limonius agonus* (Say) in south-western Ontario, insecticides were applied once in early June 1951, mid-May 1952 or late May 1953 to very heavily infested, newly ploughed soil in plots 20 ft. square that were subsequently cropped with early potatoes, and the results were evaluated on the basis of tuber quality and numbers of wireworms taken at baits of moistened whole-wheat flour, of which five were distributed at a depth of 4 in. in each plot. When applied in water suspensions at 5 lb. per acre, dieldrin, heptachlor and aldrin prevented re-infestation for at least three years after application and chlordane for two. Only plots treated with

dieldrin or heptachlor produced 95 per cent. or more marketable potatoes in the year of application. BHC containing 12, 90 and 99 per cent. γ isomer at 0·75 lb. γ isomer, parathion at 5 lb. and DDT at 10 lb. per acre gave inadequate protection or were effective for only 1–2 years. Against a moderate infestation, all treatments except BHC containing 90 per cent. γ isomer and DDT protected the potatoes satisfactorily in the year of application. BHC tainted tubers for up to two years after it had been applied. Adequate protection was generally provided when the infestation averaged no more than one larva per bait.

Srivastava (B. K.). *Stegobium paniceum* **as a Pest of stored Turmeric, in Rajasthan, India and its Control by Fumigation.**—*FAO Plant Prot. Bull.* **7** no. 8 pp. 113–114. Rome, 1959.

The Anobiid, *Stegobium paniceum* (L.), was recently found causing severe damage to stored turmeric rhizomes in Rajasthan, India. Investigations on its bionomics showed that the life-cycle is completed in about six weeks in the rainy season. The eggs are laid loosely among the turmeric pieces, and the larvae tunnel through the latter and pupate in small, parchment-like cocoons in the tunnels. The adults lived for 1–3 weeks in the laboratory, and the females laid 40–60 eggs each. In fumigation tests, the best control was given by a 1:19 mixture of ethylene dibromide and carbon tetrachloride, applied at 8 lb. per 1,000 cu. ft. for 24 hours. This killed all the adults, 55·8 per cent. of the pupae, 97·4 per cent. of the larvae and 78·9 per cent. of the eggs. Other fumigants were less effective against the immature stages, especially the eggs.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **7** no. 8 p. 115, 2 refs. Rome, 1959.

H. E. Box reports that larvae and adults of a species of *Diatraea* obtained early in 1959 from sugar-cane and the wild *Paspalum virgatum* in Guadeloupe proved to be *D. impersonatella* (Wlk.), a species hitherto recorded from the West Indies only in Trinidad, where it is the dominant borer in sugar-cane [*cf. R.A.E.*, A **30** 607]. *D. saccharalis* (F.) is the only member of the genus hitherto known in Guadeloupe. *D. impersonatella* is widely distributed in South America, but is of economic importance only in two widely separated parts of Venezuela [*cf.* **39** 93], and is thought to have been accidentally introduced into Guadeloupe from Trinidad some years ago. It is parasitised by two Tachinids, *Metagonistylum minense* Tns. and *Lixophaga diatraeae* (Tns.), which were introduced into Guadeloupe for the control of *D. saccharalis*.

Murthy (D. V.). **A short Note on the Banana Leaf Thrips**—*Caliothrips* (= *Heliothrips*) *kadaliphila* **Ramkr. M.**—*Mysore agric. J.* **33** no. 1 pp. 2–4, 1 ref. Bangalore, 1958.

Heliothrips (*Caliothrips*) *kadaliphila* Ram. Ayyar & Marg., the nymphs and adults of which are briefly described, is one of the more important pests of banana in southern India [*cf. R.A.E.*, A **32** 410], where it appears to be widely distributed. The adults and nymphs occur on the lower surface of the leaves, and up to 57 have been observed on a single leaf. They puncture the tissue, sucking the sap and causing the leaf to develop yellow patches

or to wither if the infestation is severe. The eggs are laid in the leaf tissue and hatch in 4–6 days, and the life-cycle is completed in 9–12 days at temperatures of 70–84°F. The insect occurs throughout the year, but attack is most severe in June–September, the south-west monsoon months.

Siva Shankara Sastry (K. S.). **Some Observations on** *Tettigella spectra* **(Distant) on Paddy in Mysore.**—*Mysore agric. J.* **33** no. 1 pp. 11–12, 2 refs. Bangalore, 1958.

Rice in various parts of southern India, including Mysore, is infested by a white form of *Tettigella spectra* (Dist.) that also infests other cereals, wild grasses and sugar-cane. A larger, green form of the Cicadellid also occurs on sugar-cane, but does not attack rice. On rice, the nymphs and adults of the white form suck the sap of the plant, causing the appearance of whitish patches on the leaves and delaying the development of seedlings, and the eggs are laid in incisions, mostly in the leaf-sheaths on the stem. On sugar-cane, most of the eggs are laid in the leaf laminae, the nymphs hatch in 15 days, and the complete life-cycle lasts 47 days in July–August. The eggs are parasitised by *Lymacnon* (*Gonatocerus*) sp. and the adults by *Halictophagus* (*Pyrilloxenos*) sp.; a mite of the genus *Leptus* attacks both nymphs and adults.

Tsuji (H.). **Studies on the Diapause of the Indian-meal Moth,** *Plodia interpunctella* **Hübner. I. The Influence of Temperature on the Diapause, and the Type of Diapause.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **2** no. 1 pp. 17–23, 3 graphs, 6 refs. Tokyo, 1958. (With a Summary in English.)

Full-fed larvae of *Plodia interpunctella* (Hb.) sometimes enter diapause, and the effect of temperature on the initiation of this was investigated in the laboratory in Japan, rice bran being used as the food. When the initial rearing temperature was 30°C. [86°F.] and the insects were transferred to 20°C. [68°F.] in successive stages of development, all entered diapause as full-fed larvae if transfer occurred at the egg stage or in any of the first three larval instars, and some did so when it occurred in the fourth or fifth instars, the remainder pupating after a normal period. Larvae in diapause were not completely inactive, but they contained more fat and less water, and were yellower in colour and heavier in weight, than normal larvae and wandered away from the food. When returned to 30°C., they pupated at once. Normal larvae cannot survive exposure to 5–10°C. [41–50°F.], but diapause larvae survived and pupated rapidly when returned to 20°C. after it.

Tamura (I.) & Yamanouchi (A.). **Studies on the Bionomics of** *Sylepta ruralis* **Scopoli (Pyralidae).** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **2** no. 1 pp. 24–32, 5 graphs, 8 refs. Tokyo, 1958. (With a Summary in English.)

The larvae of *Sylepta ruralis* (Scop.) roll the leaves of soy bean in Japan. In light-trap catches, the number of adults increased gradually from the beginning of July to a maximum in the middle of that month and then gradually decreased, and the numbers of egg-masses on the leaves varied similarly, reaching their peak on 21st July. Most leaves bore only one egg-mass, but some bore two or three, and the masses contained up to 12

eggs, but usually not more than two. The egg, larval and pupal stages lasted about 5, 17 and 9 days, respectively. Oviposition was heaviest on varieties in flower at the time and on plants having the greatest number of leaves, and only half as many eggs were laid for the first four days on plants that had been kept in the dark for five days in mid-July as on normal plants.

Utida (S.) & Takahashi (F.). **"Phase" Dimorphism observed in the Laboratory Population of the Cowpea Weevil,** *Callosobruchus quadrimaculatus*. **III. Chemical Differences of Body Constituents between two Phases.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **2** no. 1 pp. 33–37, 2 graphs, 6 refs. Tokyo, 1958. (With a Summary in English.)

It is shown in this third part of a series [*cf. R.A.E.*, A **47** 389] that the body weight of adults of *Callosobruchus maculatus* (F.) decreases during adult life, but more so in the flying than in the non-flying form, and, in the latter, more in males than in females. Water content remained fairly constant, but was greater for the non-flying than for the flying form and greater for males than for females. Crude fat content was also higher for the flying form, and there was a difference in the acid and iodine values of the fat of the two forms, but none in the saponification value. It is inferred that the flying form undergoes a diapause in the initial stages of adult life [*cf.* **46** 213].

Koidsumi (K.) & Takahashi (Y.). **Structure of Cuticle and Entry of Insecticides through Integument of the Rice Stem Borer.**—*Jap. J. appl. Ent. Zool.* **2** no. 1 pp. 43–49, 6 figs., 9 refs. Tokyo, 1958. (With a Summary in Japanese.)

Details are given of experiments in which larvae of *Chilo suppressalis* (Wlk.) at the beginning of the hibernation period were treated topically on various parts of the body with 5 μl. commercial emulsion concentrate containing 10 per cent. γ BHC, or 1 μl. concentrate containing 46·6 per cent. parathion, and the times required for death noted. The averages in minutes for γ BHC and (in brackets) parathion were 129·3 (134·3) for the thoracic sclerites, 131·9 (141·5) for the abdominal sclerites, 112·4 (118·2) for the intersegmental membranes, 92·5 (69·6) for the spiracles, 95 (77·5) for the thoracic and abdominal legs and 158·7 (114) for the caudal legs. The differences may be due to differences in structure of the cuticle at the different sites, which is described.

Ossowski (L. L. J.). **Forstentomologische Probleme im Verbreitungsgebiet der Schwarzakazie,** *Acacia mollissima* **Willd., in der Südafrikanischen Union.** [Problems of Forest Entomology in the Distribution Area of Black Wattle, *A. mollissima*, in the Union of South Africa.]—*Anz. Schädlingsk.* **30** pt. 9 pp. 133–137, 6 figs., 4 refs. Berlin, 1957.

Black wattle (*Acacia mollissima*) covers about 39 per cent. of the total acreage of exotic trees in the Union of South Africa and 30 per cent. of the total wooded area. In this paper, the author gives notes on the more important Lepidoptera, Hemiptera and Coleoptera that attack it there.

Outbreaks of the indigenous *Kotochalia junodi* (Heyl.), the commonest of all the pests, last several years and cause severe defoliation or even death of the trees. Measures used for the control of this Psychid are briefly reviewed. Treatment with toxaphene in oil solution [*cf. R.A.E.*, A **46** 299,

etc.] sometimes gives satisfactory control for a year but does not prevent an outbreak, and chemical measures are recommended only for young plantations, which suffer most from defoliation, and for trees from which no bark can be obtained owing to defoliation. In work on the use of a polyhedral virus [*cf.* **45** 385], recent tests have shown that suspensions containing 1,000 polyhedra per cu. mm., applied at about 2·7–3·6 gal. per acre on trees 39–45 ft. high, gave an average mortality of 94 per cent. after 4–5 weeks.

The foliage is also damaged by three Lasiocampids, of which *Anadiasa punctifascia* (Wlk.) is the most widespread. It has two generations a year, the adults appearing in October and February. Feeding by the summer generation sometimes continues for more than three months, and the larvae are a nuisance because of their urticating hairs. They are parasitised by a species of *Charops* that pupates in cocoons suspended from the twigs, and also by *Sturmia idonea* (Br. & Berg.), and preyed on by *Glypsus moestus* (Germ.). The others are *Pachypasa truncata* (Wlk.), which also has two generations a year, is fairly common, has several parasites and has been satisfactorily controlled over small areas by twice-yearly sprays of BHC or toxaphene in oil, and *Gonometa postica* Wlk., which has one generation a year, has several insect parasites and is frequently controlled by a virus disease of the larvae. The foliage is also injured by the larvae of *Achaea lienardi* (Boisd.), the most injurious Noctuid present. The number of generations produced per year by the latter depends on the climate, and ranges from one and exceptionally two in central Natal to three nearer the east coast, and outbreaks occur every 8–10 years, usually following retarded summer rain. Its natural enemies comprise Pentatomids, Sphegids and two Tachinid parasites, *Tachina fallax* Mg. and *Sturmia* (*Zygobothria*) *inconspicua* (Mg.). Of the two most important Saturniids that defoliate the trees, *Gonimbrasia tyrrhea* (Cram.) is most injurious in the eastern part of Cape Province and also attacks pine, which is replacing black wattle there, and *Gynanisa maia* (Dru.) normally damages only younger stands. The first is parasitised by *Apanteles aethiopicus* Wlkn. and the second by *A. maculitarsis* Cam.

The principal Hemiptera are the Mirid, *Lygidolon laevigatum* Reut., and the Cicadellid, *Bythoscopus cedaranus* Naudé [*cf.* **15** 330]. Oil solutions of toxaphene or 4 per cent. BHC applied in November–December, during the main oviposition period and before the damage becomes apparent [*cf.* **29** 278], give good control, and a spray affording 0·2 lb. toxaphene and 2 gal. light mineral oil per acre gave an average mortality of 98·8 per cent. Since there are several generations a year and 3–4 applications would presumably be required annually, insecticidal control must be considered uneconomic. The BHC spray applied at one tenth the rate gave complete control of *Lygidolon* but only 1·8 per cent control of *Bythoscopus*. Thinning of stands should be postponed until April–May, when the main attack is over and deformation of the trees has become more obvious.

Among the Coleoptera, two Melolonthids are injurious, *Hypopholis sommeri* Burm., which is present in all areas and of which the larvae cause the main damage, the adults defoliating the trees only during outbreaks, and *Monochelus calcaratus* Burm., adults of which are numerous but which prefers willow. Both have one generation a year, the adults appearing in October–November. Although sprays applied against *K. junodi* also killed the adult beetles, large numbers appeared in the following year, evidently owing to mortality of polyphagous parasites. Considerable control of the adults of *Hypopholis* is afforded by birds. Adults of the polyphagous weevils, *Pantomorus godmani* (Crotch), *Ellimenistes laesicollis* Fhs. and *Auletobius decipiens* (Lea), gnaw the bark of thinner trunks and also injure the shoots, which are then easily broken by wind. *E. laesicollis* frequently destroys all

young growth, thus preventing the establishment of new trees in many areas. The weevils appear to have at least three generations a year, all stages being present continuously. Adults of the Lamiid, *Pycnopsis brachyptera* Thoms. damage the bark [*cf.* **25** 753]. *Apate indistincta* Murray and *Sinoxylon ruficorne* Fhs. are the most numerous Bostrychids present. The adults bore short galleries in the trunk and oviposit in them, and the larvae bore and pupate within the wood. Adults of *Sinoxylon* also attack green twigs and very thin trunks, boring axial galleries in them in their search for food or winter quarters and causing them to break off. The duration of development varies considerably. In the laboratory, that of some individuals lasted 4–6 months and that of others, 12–15; there are probably 2–3 generations a year under favourable conditions. Control measures are similar to those recommended against *P. brachyptera* [*cf.* **25** 753].

It is also reported that when black wattle was sown over large areas in Southern Rhodesia after the late war, adults of *Eulepida mashona* Arr. were attracted by the freshly-turned soil, in which they oviposited, and the roots of the seedlings were much damaged by the larvae, necessitating replanting. The damage increased yearly and even older saplings were killed. This Melolonthid has one generation a year, the adults emerging in November. Control measures were carried out in 1951–53, when soil insecticides were applied in the plantations and native trees in the infested area sprayed with toxaphene or BHC. These measures and the ploughing up of large areas of veldt reduced the population to more normal levels. All areas liable to infestation are now treated with soil insecticides. Many of the larvae and pupae are attacked by a fungus of the genus *Cordyceps*, and some control is afforded by *Dexia* sp., *Muscina stabulans* (Fall.) and a mite, *Caloglyphus berlesei* (Michael).

Inouye (M.). **Die Einschleppung des Amerikanischen Webebären (*Hyphantria cunea* Drury) in Japan nach dem 2. Weltkrieg.** [The Introduction of *H. cunea* into Japan after the Second World War.]—*Anz. Schädlingsk.* **30** pt. 9 pp. 137–139, 13 refs. Berlin, 1957.

Hyphantria cunea (Dru.), which appeared in Japan after the late war [*cf. R.A.E.*, A **41** 356], apparently as a result of introduction from the United States, caused considerable damage in and round Tokyo as early as 1946. By 1954, it had spread to most of northern and western Honshu and southwards as far as the province of Okoyama. In Tokyo, trees and shrubs used for ornamental or shade purposes were heavily attacked, and a list is given of 21 plants, including these and a few miscellaneous crops, on which the larvae were observed feeding in 1949–50. The Arctiid has two generations a year. The pupae overwinter in cocoons on the ground beneath broken twigs or in crevices in the bark, and the adults emerge in May–June. The females lay up to 700 eggs each on the lower surfaces of leaves, and the larvae hatch in about 12 days and feed within large webs [*cf.* **36** 254] for 4–5 weeks, after which they crawl down the trees to pupate. Adults emerge 11–20 days later, from 15th July to 10th August, and give rise to the second generation, of which the larvae are present from July to September and the overwintering pupae from September onward. Larvae of the first generation prefer young leaves of *Prunus* spp. and *Salix babylonica*, whereas those of the second prefer *Platanus orientalis* and *Fraxinus japonica*. The eggs are parasitised by *Trichogramma dendrolimi* Mats., the larvae by *Tachina* (*Eutachina*) *japonica* Tns., *Zenillia libatrix* (Panz.), *Pales pavida* (Mg.) and *Pimpla aethiops* Curt. (*atcrrima* Grav.), and the pupae by *Brachymeria obscurata* (Wlk.) and *Pteromalus* sp. In addition, the larvae are attacked by a virus, and the pupae and adults by two fungi, *Isaria farinosa* and

Aspergillus sp. Control methods comprise the removal or burning of the larval nests or the use of chemicals. Dusts of 0·5 per cent. BHC or 10 per cent. DDT and sprays of 0·5–1 per cent. DDT have proved effective.

Jahn (E.) & Sinreich (A.). **Beobachtungen zum Auftreten des Schwammspinners (*Lymantria dispar* L.) des Goldafters (*Euproctis chrysorrhoea* L.) und des grünen Eichenwicklers (*Tortrix viridana* L.) in Niederösterreich und im Burgenland in den Jahren 1952 bis 1956.** [Observations on the Occurrence of *L. dispar*, *E. similis* and *T. viridana* in Lower Austria and in the Burgenland in the Years 1952–56.]—*Anz. Schädlingsk.* **30** pt. 9 pp. 139–146, 8 figs., 1 map, 4 refs. Berlin, 1957.

Outbreaks of *Lymantria dispar* (L.), *Euproctis similis* (Fuessly) (*chrysorrhoea*, auct.) and *Tortrix viridana* (L.) occurred in eastern Austria in 1952–56, and their geographical distribution is shown on a map. Those of *L. dispar* began near Wolkersdorf, in the north-east of Lower Austria, and to the south-east of Vienna, in the Burgenland, in 1952 and spread in the following years to many forest localities in these regions. Oak was the principal tree attacked, but other broad-leaved trees and, in one locality, conifers were also infested. Up to 10–15 overwintering egg-masses were found per trunk; eggs collected in the Burgenland and sent to the laboratory on 11th April 1956 hatched from 16th April, and eggs sent from Lower Austria on 15th April hatched from 20th April. Most larvae were in the second or third instar on 24th May in the latter area, and larvae collected at the end of May in one locality pupated in the second half of June and in July, the first adults emerging at the end of July. The numbers of larvae hatching in the field in the spring of 1956 were, on the whole, considerable, and infestation in the Burgenland was greater than in the previous year, but observations in one locality in Lower Austria showed that some eggs, as had been also observed in 1955, were diseased, and few eggs in another locality gave rise to healthy larvae. The young larvae that hatched were generally healthy, but very many older ones were diseased and many parasitised, and the numbers of adults emerging were lower than in 1955. Predators were numerous. By March 1957, the numbers of egg-masses were generally reduced by 90 per cent., as compared with the previous year, and a mite, *Allothrombium wolffi* Krausse, was observed preying on them in numbers in one locality in the Burgenland in March. When eggs and young larvae were reared in the laboratory, *Perilampus ruficornis* (F.) emerged from a larva on 8th March 1954, and *Brachymeria intermedia* (Nees) and *Monodontomerus aereus* Wlk. from pupae on 10th August 1953. Notes are given on chemical control measures applied.

The principal outbreak of *E. similis* occurred in similar parts of Lower Austria and also began in 1952, spreading in the following years. The worst damage comprised defoliation of oaks, but fruit trees were also injured and other broad-leaved trees attacked. The larvae overwinter in nests of leaves, and feeding had begun by 10th May in 1956, although many larvae appeared to have been frozen to death. The larvae were in an advanced stage of development by 25th May, but many were diseased by that time, and of two batches of 500 larvae taken to the laboratory, only 70 of the first batch were alive on 28th May and none on 1st July, and though a few pupae (together with a few adult parasites) developed in the second batch, in the first half of June, no adults emerged. The high mortality was almost entirely due to the fungus, *Entomophthora aulicae*, which spread to almost all outbreak localities. In the spring of 1957, the reductions in population as compared with the previous year were 75–100 per cent. In the laboratory, adults of *M.*

aercus emerged from young larvae collected in May 1956. It is also reported that an outbreak of *E. similis* occurred during this period in the Innsbruck district, causing much damage to fruit trees. For control, dusts of parathion, DDT or BHC proved effective.

The outbreak of *T. viridana* began in various localities in the north-east of Lower Austria in 1954 and had spread widely by 1956, when some infestation was also observed near Vienna. Damage was mainly confined to the lower parts of the crowns of oaks, although other broad-leaved trees were also attacked. The date at which the larvae hatched appeared to vary considerably in 1956. The first pupae were found on 4th June, and material collected on 12th June gave rise to some adults on the following day, although numerous larvae were still present. In laboratory rearings, larvae hatched from 13th June to 14th July. Rearing of examples of *T. viridana* and *T.* (*Cacoecia*) *xylosteana* (L.), which were frequently present together, from a locality in Lower Austria at the beginning of June 1956, showed that 40 per cent. of the larvae and pupae of the two were parasitised by numerous Hymenoptera. The most important were *Phaeogenes invisor* (Thnb.) (*stimulator* (Grav.)), *Itoplectis* (*Pimpla*) *maculator* (F.) and *Apechthis* (*P.*) *rufata* (Gmel.), all three of which parasitised both species.

Zischka (R.). **Über einen neuen südamerikanischen Grossschädling des Zuckerrohres.** [On a new major Pest of Sugar-cane in South America.] —*Anz. Schädlingsk.* **30** pt. 9 pp. 146–148, 2 figs. Berlin, 1957.

Damage to sugar-cane to the north and north-west of Santa Cruz, Bolivia, by a borer later described as *Metamasius bilobus* Hust. was observed about 1925, when the crop was first cultivated on a large scale. It increased with the increase in the area under the crop, and was severe in 1952 [*cf. R.A.E.*, A **43** 115], when large areas of cane were burnt in an effort to achieve control; this caused a reduction in the infestation the following year. The females of this weevil lay their eggs singly in the growing stems, in which the larvae feed for several months, and development from oviposition to emergence lasts about six months. Observations in 1955 showed that the larvae normally bred in the decaying trunks of *Attalea princeps*, a palm that is widespread in the area. Felling of this tree is carried out on a large scale to make way for cane plantations, and excellent conditions are thus provided for larval development in the trunks. These became unsuitable for further breeding by the time the adults emerge, and, since felling is carried out only once a year, they therefore move to the canes, which have already completed half their growth on the cleared sites. The destruction of all felled *Attalea* trunks 2–3 months after felling is considered the best method of control.

Frey (W.). **Untersuchungen über den Schädlingsbefall von Getreideimporten.** [Investigations on the Infestation of Grain Imports.]—*Anz. Schädlingsk.* **30** pt. 9 pp. 148–153, 2 figs., 18 refs. Berlin, 1957.

Much of the grain imported into Germany after the war was infested by insects, and it has been calculated that only 27 per cent. of that arriving in 1948–51 was free of infestation. Examination of cargoes was carried out at various German ports from 1st June 1952 to 31st May 1953 and in warehouses in 1952–56, and the results are discussed and the insects and mites found listed. It was observed that *Rhizopertha dominica* (F.), which is known to withstand only with difficulty temperatures of under 25°C. [77°F.],

sometimes overwintered in grain rendered warmer as a result of infestation by *Calandra* and that it survived the cold winter of 1956–57 in a wheat silo. Unlike *C. granaria* (L.), which was also observed, *C. oryzae* (L.) is unable to overwinter in unheated places and has not become established in Germany. *Trogoderma granarium* Everts attacked barley and maize, and barley that had been placed in storage in Westphalia in December 1952 was observed to be infested by it in May 1954. Although this species does not appear to have become established in Germany, it is evidently able to withstand very low temperatures. *Sitotroga cerealella* (Ol.) was found in grain on several occasions, but caused little damage and did not become established. *Ephestia elutella* (Hb.) was the commonest moth in 1955–56, and *Plodia interpunctella* (Hb.), which was probably rather less widespread, was found repeatedly on maize. A table is appended showing, by countries of origin, the numbers of grain cargoes examined officially in German ports from May to December 1956, the proportion of grain infested and the degree of infestation. Of all the grain concerned, 46 per cent. was found to be infested.

Krieg (A.). **Eine Polyedrose von *Aporia crataegi* L. (Lepidoptera). (Zugleich ein Beitrag über den atypischen Verlauf von Insekten-Virosen.)** [A Polyhedrosis of *A. crataegi*. (Also a Contribution on the atypical Course of Insect Viroses.)]—*Z. PflKrankh.* **64** pt. 11 pp. 657–662, 2 graphs, 7 refs. Stuttgart, 1957. (With a Summary in English.)

The following is based on the author's summary. An account is given of laboratory experiments in Germany in which the virus described as *Borrelina aporiae* [*R.A.E.*, A **46** 291] was used to infect larvae of *Aporia crataegi* (L.) that were either healthy or had a latent infection with the same virus. Infection was achieved by feeding on leaves dipped in virus suspensions at different concentrations. It was found that the incubation period in the insects lasted eight days and that half the insects were dead in 12·5 days and all in 25 days. The infection rate varied with the concentration of the suspensions and the age of the larvae. Infection of late-instar larvae, latent infections and interference by bacteria resulted in atypical phenomena, which are discussed. The use of food dipped in 0·05 per cent. sodium fluoride caused acute virosis in latently infected larvae. The virus did not prove infective for larvae of *Pieris brassicae* (L.).

Merker (E.). **Die oekologischen Ursachen der Massenvermehrung des grossen Fichtenborkenkäfers in Südwestdeutschland während der Jahre 1941 bis 1951. Teil I. Die klimatische Abhängigkeit des grossen Fichtenborkenkäfers (*Ips typographus* L.) bei seiner Verbreitung in Eurasien, im Frühjahr beim Erscheinen und beim Brutflug.** [The ecological Causes of the Outbreak of *I. typographus* in south-western Germany in 1941–51. Part I. The climatic Dependence of *I. typographus* in its Distribution in Eurasia, its Appearance in Spring and its Breeding Flight.]—140 pp., 36 figs., 1 map, 1 fldg. table, 4½ pp. refs. Freiburg, 1957.

A severe outbreak of *Ips typographus* (L.) occurred on spruce in central Europe during the warm years of 1941–51, reaching its peak in many places in 1947 [*cf. R.A.E.*, A **39** 32]. The bark-beetle was of little importance before and after that period, but the damage caused during it was very great. Prolonged studies on the causes of the increase were made in

Germany and elsewhere [*cf.* **43** 20; **46** 460], and it was found that weather was largely responsible. The susceptibility of standing timber to attack was greatest in places in which the water economy of the trees fell below the optimum, as a result of the hot summers, and cambial temperatures reached the most favourable level for the beetle. High osmotic pressure of the sap and high cambial temperatures led to increased evaporation from the bark, which attracted the beetles to favourable breeding sites, and mass breeding resulted.

The author's observations were carried out in south-western Germany and are to be reported in a series of papers, of which this is the first. In it, he reviews the distribution of *I. typographus* in Europe and Asia and its climatic limits and records observations on the influence of climate on the time of appearance of the beetles in spring and their flight to their breeding sites. Information from other regions is included, and the following is based on his summary of the findings.

The overwintered beetles do not become active until the soil temperature reaches 7°C. [44·6°F.], appearing mostly at the end of March and the beginning of April, but sometimes not until May or June, when the temperature at the soil surface reaches 10–20°C. [50–68°F.]. On northern slopes they frequently remain in the soil until mid-June. Maturation feeding is completed beneath the bark of trees and stumps, and swarming occurs when atmospheric pressure is high and the temperature at least 20°C., provided that sexual maturity has been reached. For flight, a body temperature of 23°C. [73·4°F.] is required, whether the beetles are exposed to direct sunshine or not, and at that temperature flight occurs even in the reduced light of the forest. Maturation feeding lasted only ten days in 1947, but required 20 days in 1948. In favourable weather, swarming flights begin in mid-April. At first they are confined to the middle of the day, but later, in May and June, they begin earlier and end later, as the daily period of favourable temperature increases. They are interrupted by cool periods, rain and wind.

Infestation occurs first at the edges of stands, but later, with increasing temperatures, spreads to the interior, the beetles reaching the trees by flight and by crawling. Trees with bark temperatures of 27–33°C. [80·6–91·4°F.] are preferred, and these temperatures are reached throughout whole stands in summer. If the trunks are warmed unevenly, the warmest sites are found, as a result of the increased evaporation from them. Bark temperatures over 40°C. [104°F.] are unfavourable for the brood. Minimum temperature requirements in Scandinavia, Austria and Switzerland are the same in spring, but differ later.

Szmidt (A.). **Spostrzeżenia nad szkodnikami żołędzi** *Balaninus glandium* **Mrsch. (Curculionidae, Col.) i** *Laspeyresia splendana* **Hb. (Tortricidae, Lep.) oraz analiza metod zwalczania tych szkodników i zapobiegania stratom.** [Some Observations on the Acorn-destroying Insects *Curculio glandium* and *Cydia splendana* and an Analysis of Methods of controlling these destructive Insects and preventing Losses.]—*Roczn. Wyższej Szk. roln. Poznan.* **1** pp. 117–128, 1 graph, 11 refs. [Poznan] 1957. (With Summaries in English & Russian.)

The following is based on the author's summary. In view of the demand for acorns for seed in Poland, investigations were made in Ludwikow and Poznan in 1950–54 on the loss of these caused by insect pests. Plots were established under oak trees, and the acorns falling on them were collected and examined. It was found that up to 50 per cent. were destroyed by insects, of which the most important were *Curculio* (*Balaninus*) *glandium*

Marsham and *Cydia* (*Laspeyresia*) *splendana* (Hb.). The bionomics and control of these are briefly discussed.

Koehler (W.). **Występowanie szkodliwych owadów w okresie powojennego dziesięciolecia.** [Occurrence of injurious Insects in the post-war Decade.]—*Sylwan* **102** pt. 4 pp. 18–37, 1 ref. Warsaw, 1958. (With Summaries in Russian & English.)

The following is based on the author's summary. Insect infestation in forests in Poland after the late war was heavy, owing to war-time neglect of cultural methods, fire damage and exceptional weather in several years. The more important pests recorded in 1945–57 included *Acantholyda pinivora* Ensl. (*nemoralis* (Thoms.)), of which there appeared to be two forms, one in the south-east and the other in the south-west [*cf. R.A.E.*, A **43** 390], *A. erythrocephala* (L.) in eastern Pomerania, *Dendrolimus pini* (L.) along the Oder river, in central Poland and in the Torun Forest district, *Panolis flammea* (Schiff.) in northern and western Poland, *Rhyacionia* (*Evetria*) *buoliana* (Schiff.) in central Poland, *Exotelcia* (*Heringia*) *dodecella* (L.) in industrial areas, *Monochamus galloprovincialis* (Ol.), *Myelophilus* (*Blastophagus*) *piniperda* (L.) and *M. minor* (Htg.), all on pine; *Lymantria monacha* (L.) on pine and occasionally on spruce; *Ips typographus* (L.) and *I. duplicatus* (Sahlb.) on spruce; *Enarmonia* (*Semasia*) *rufimitrana* (H.-S.) and *Choristoneura* (*Cacoecia*) *murinana* (Hb.) on fir (*Abies alba* (*pectinata*)) in the mountains round Kielce; and *Dasychira pudibunda* (L.) on oak. Sprays were applied from the air where infestations were serious, but parasites effectively controlled many of the Lepidoptera.

Gołębiowska (Z.). **Badania nad porażeniem krzycy pastewnej przez ploniarkę zbożówkę** (*Oscinella frit* **L.).** [Investigations on Damage to Forage Rye caused by the Frit Fly (*O. frit*).]—*Roczn. Nauk roln.* **77** (A) pt. 4 pp. 519–542, 6 graphs, 8 refs. Warsaw, 1958. (With Summaries in Russian & English.)

The following is based on the author's summary. Observations in Pulawy, Poland, in 1949–55 on the best sowing date to avoid infestation of rye grown for forage by *Oscinella frit* (L.) showed that infestation was highest on rye sown in May or June, lower in that sown in July and least in that sown in August. As no crop was obtained from August-sown rye, mid-July is recommended. Spring infestation reduced the yield of the first cutting, but had no noticeable effect on the autumn crop or on the spring crop of the following year. Cutting the young rye did not attract the flies, and there were no significant differences in the infestation of cut and uncut crops.

Miczulski (B.). **Nowy dla Polski szkodnik nasion esparcety—zagładek esparcetowy** *Eurytoma onobrychidis* **Nik. (Chalcidoidea).** [The Sainfoin-seed Chalcidoid, *E. onobrychidis*. A new Pest of Sainfoin Seed in Poland.]—*Roczn. Nauk roln.* **77** (A) pt. 4 pp. 543–554, 7 figs., 10 refs. Warsaw, 1958. (With Summaries in Russian & English.)

The following is based on the author's summary. *Eurytoma onobrychidis* Nikol'skaya and *Bruchidius unicolor* (Ol.) were found for the first time in Poland in the seeds of sainfoin (*Onobrychis sativa*) in the seed-cleaning

factory at Lublin in 1953. *E. onobrychidis* occurred in samples from Kielce, Lublin and Bialystok, and investigations in 1953–56 showed that 1–5 per cent. of seeds were damaged. *E. onobrychidis* was parasitised by *Tetrastichus tibialis* (Kurd.).

Miczulski (B.). **Obserwacje nad pryszczarkiem kapustnikiem, *Dasyneura brassicae* (Winn.).** [Observations on the Bladder Pod Midge, *D. brassicae*.]—*Roczn. Nauk roln.* **77** (A) pt. 4 pp. 555–576, 5 figs., 26 refs. Warsaw, 1958. (With Summaries in Russian & English.)

The following is based on the author's summary. Observations were made on the occurrence and extent of damage by *Dasyneura brassicae* (Winn.) to the pods of rape (chiefly winter rape) in the Lublin and Pulawy districts of Poland in 1953–56. The Cecidomyiid appeared to have two main generations a year, the spring one developing on winter rape and the summer one on summer rape, and occasionally a third generation on summer rape when conditions were exceptionally favourable. Mild winters and warm, damp springs favoured population increase, and the dependence of infestation by *D. brassicae* on that by *Ceutorhynchus assimilis* (Payk.) and other insects, including Heteroptera, was confirmed [*cf. R.A.E.*, A **46** 401, etc.]. Infestation caused losses of 15·2–23·8 per cent. of the pods of winter rape and about 16·9 per cent. of those of summer rape in 1953, but damage was insignificant in the other years. About 21 per cent. of the pods of summer rape infested by larvae of *D. brassicae* also contained larvae of an unidentified Chalcidoid parasite.

Györfi (J.). **Nadelholzzapfen- und Nadelholzsamenschädlinge und ihre Parasiten.** [Pests of the Cones and Seeds of Coniferous Trees and their Parasites.]—*Acta agron.* **6** fasc. 3–4 pp. 321–373, 18 figs., 1 map, 56 refs. Budapest, 1956. (With Summaries in Russian & English.)

The investigations described were carried out in the Carpathian basin of Hungary in 1932–51, during which period 146 cone samples from 57 localities were studied, and although spruce was the tree originally selected, the work was later broadened to include as many conifers as possible. Infestation by insect pests was very variable, ranging from 0 to 84 per cent. of the seeds, and it appeared that seed losses due to insects averaged about 15–20 per cent. In addition to pests, many other insects and also spiders were found sheltering in the cones, but these, though possibly of some economic importance, are not further considered.

The pests observed comprised nine species that fed on the cones, including *Pissodes validirostris* (Sahlb.) and *Hyphantidium terebrellum* (Zk.) on pines, various Cecidomyiids, notably *Dasyneura* (*Kaltenbachia* [sic]) *strobi* (Winn.), on spruces, and *Cydia* (*Laspeyresia*) *illutana* (H.-S.) on *Abies nordmanniana*, seven that fed on the seeds, including *Megastigmus suspectus* Borries on *A. alba*, *M. spermotrophus* Wachtl, which was introduced into Europe in seed from North America, on *A. concolor* and *Pseudotsuga menziesii* (*taxifolia*), *Resseliella piceae* Seitner on *Abies* spp., *Plemeliella abietina* Seitner on spruce, *Megaselia rufipes* (Mg.) on pines and *Pseudotsuga*, and *Hylemyia* (*Chortophila*) *laricicola* (Karl) on *Tsuga canadensis* and larch, and 14 that injured both cones and seeds, including nine species of *Ernobius*, of which the commonest was *E. abietis* (F.), on various conifers, *Barbara* (*Evetria*) *margarotana* (H.-S.) on *A. alba*, ponderosa pine (*Pinus ponderosa*) and spruce, *Cydia* (*Laspeyresia*) *strobilella* (L.) on pines and *Pseudotsuga*

menziesii, *Dioryctria abietella* (Schiff.) on *A. alba*, spruce and pines, and two species of *Tephroclystia* on spruce. Notes on the distribution and bionomics of most of these are given, together with a table showing the pests, arranged in these three groups, of the principal conifers considered. Of all the trees, the most heavily infested was spruce, which, it is remarked, is the one most commonly misused.

Parasites were also reared, and a list is given of the 52 species obtained, with notes on their distribution and hosts, and another of the host insects, showing the parasites that attacked them. *Cydia strobilella*, *Dasyneura strobi* and *Ernobius abietis*, which were the three commonest pests, had the greatest number of parasites, and 15 minor pests had none.

Szalay-Marzsó (L.). **Populationsdynamische Untersuchungen an Beständen der Rübenblattlaus (*Aphis* (*Doralis*) *fabae* Scop.) in Ungarn, in den Jahren 1955 und 56.** [Investigations on the Population Dynamics of Stocks of the Beet Aphid (*A. fabae*) in Hungary in the Years 1955 and 1956.]—*Acta agron.* **8** fasc. 3–4 pp. 187–211, 10 figs., 9 graphs, 21 refs. Budapest, 1958. (With Summaries in English & Russian.)

The following is based on the author's summary. Investigations on the changes in population of *Aphis fabae* Scop. on sugar-beet and their causes were made in two separate districts in Hungary in 1955 [*R.A.E.*, A **47** 1] and 1956. Weekly counts showed that infestation began at the end of May in both years, after which there was a rapid increase in numbers. The peak was reached on 10th July in 1955 and 29th June in 1956, after which there was a rapid decline. Later observations in 1956 showed a second increase in September, but numbers did not regain their earlier level. Factors responsible for the summer decline included cool, rainy weather, unfavourable feeding conditions, attack by *Entomophthora* sp., which caused considerable mortality, and insect predators. The predators included *Sphaerophoria scripta* (L.), *Syrphus ribesii* (L.), *S. lunulatus* Mg., *S.* (*Epistrophe*) *balteatus* (Deg.) and *Coccinella septempunctata* L. Some of the Syrphid pupae were themselves parasitised, and a Chrysopid larva was observed attacking a pupa of *Coccinella*. In evaluating the activities of the natural enemies, dry weight of insects was found more indicative than actual numbers. In the ten days preceding the peak of the aphid population in 1956, both the dry weight and the number of aphids per unit area increased by a factor of 2·7. The numbers of Syrphid pupae decreased by one of 0·7, but the dry weight increased to 14 times its original value, indicating consumption of very large numbers of aphids by the older larvae. From consideration of these results and the growth of the crop, it is concluded that control measures should be applied in the second week after the first appearance of the aphid. Later applications are of much less value, since the aphid population is approaching its decline and alates have already begun virus transmission, and they require larger quantities of spray or dust because of plant growth.

Nikolova (V.), Minkova (S.) & Radev (R.). **Injurious Wireworms of the Family Elateridae (Coleopt.) in Bulgaria and Experiments with Chemicals for their Control.** [*In Bulgarian.*]—*Bull. Inst. zool. Acad. Sci. Bulg.* **6** pp. 233–273, 18 figs., 36 refs. Sofia, 1957. (With Summaries in Russian & German.)

The authors give records of 15 species of wireworms found to injure crop plants in Bulgaria, with keys for their separation and notes on their distribution, appearance, habits and food-plants. Several of them were not

previously classed as pests. In general, soil treatment with BHC or parathion gave good control.

Iosifov (M.). *Cercsa bubalus* F. (**Hem. Hom. Membracidae**)—**a new Pest of Fruit Trees and Lucerne in Bulgaria.** [*In Bulgarian.*]—*Bull. Inst. zool. Acad. Sci. Bulg.* **6** pp. 569–575, 28 refs. Sofia, 1957. (With Summaries in Russian & German.)

Cercsa bubalus (F.), which is stated to occur in Europe in France [*R.A.E.*, A **28** 445], Spain [**40** 212], Italy, Switzerland [**27** 169], Rumania, Hungary [**19** 423], Yugoslavia [**42** 198], Albania [**36** 37] and the Soviet Union (Moldavian Republic), was found for the first time in Bulgaria in 1943 near Sofia. It was subsequently found in other areas, notably in orchards with a cover of lucerne. The females laid their eggs in slits on the trees, and the nymphs developed on the lucerne.

Umnov (M. P.). **Forecasting the Appearance of different Stages of Pests.** [*In Russian.*]—*Zool. Zh.* **37** pt. 1 pp. 27–33, 1 graph, 15 refs. Moscow, 1958. (With a Summary in English.)

Protective sprays have proved effective in the Transcarpathian region of the Ukraine in controlling and restricting infestation by *Hyphantria cunea* (Dru.), a pest of fruit and other trees that has recently spread to the area [*cf. R.A.E.*, A **45** 330], but determination by field observation of the correct date at which to apply them is difficult. Observations were therefore made in 1953–57 on the date of mass emergence and on the temperature sum required for pupal development. A threshold of 10°C. [50°F.] and a total effective temperature of 200 day-degrees C. [360°F.], established by experiments under constant temperature conditions as necessary for the development of the pupae, were in agreement with the results of field observations in this region and in southern Slovakia for the summer generation, but it was found that as little as 157–181 day-degrees C. [282·6–325·8°F.] was required for the overwintered generation. The latter figures were calculated from the average daily temperatures, and the difference between the spring and summer totals was thought to be due to the neglect of high day-time temperatures on spring days when the average temperature was still below 10°C. Closer agreement was reached by calculating average daily temperatures from the hourly temperatures recorded each day, but this method is considered impracticable for general use. As an alternative, 9°C. [48·2°F.] should be taken as the threshold of development. This gave a total effective temperature near the experimental figure and proved reliable for forecasting mass emergence in spring.

Cadman (C. H.) & Fisken (A. G.). **Susceptibility of Raspberry Varieties to Infection by Aphid-borne Viruses.**—*J. hort. Sci.* **33** no. 1 pp. 13–20, 5 refs. London, 1958.

The following is virtually the authors' summary. Field and glasshouse experiments in Scotland with two raspberry viruses, vein-banding and leaf spot, transmitted by *Amphorophora rubi* (Kalt.) showed that raspberry varieties differed greatly in the frequency with which plants became infected. Of the varieties tested, Norfolk Giant seemed the most resistant and Lloyd George the most susceptible, but raspberry plants are relatively resistant and

both viruses spread only slowly, even in Lloyd George. Spraying plants of this variety with Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] decreased the population of *A. rubi* more than spraying with DDT emulsion or parathion; spraying with Systox also appeared to decrease the spread of vein-banding virus.

Briggs (J. B.). **Methods for assessing Resistance to *Amphorophora rubi* (Kalt.) in the Raspberry.**—*46th Rep. E. Malling Res. Sta. 1958* pp. 121–126, 8 refs. East Malling, 1959.

The following is virtually the author's summary. Techniques developed at East Malling for forecasting resistance to *Amphorophora rubi* (Kalt.) in raspberry varieties and seedlings in the insectary, and for comparing infestations on individual seedlings in the field, are described and discussed. Mass inoculation is used to locate resistance in potted varieties and selections in the insectary. A simple test for seedlings, using three inoculations of a single aphid, gave a very accurate forecast of resistance derived from Baumforth A, judged by subsequent field observation at East Malling. The use of leaf samples to estimate relative degrees of infestation in the field was examined and found adequate to check the resistance of Baumforth A derivatives in the field during the early part of the season. Unusual behaviour of the aphids on the variety Norfolk Giant is reported, the young leaves being avoided early in the season as well as later.

Reed (W.). **A preliminary Study of the Toxicity of Lime-sulphur and other Fungicides to *Psallus ambiguus* (Fall.) (Hemiptera-Heteroptera: Miridae).**—*46th Rep. E. Malling Res. Sta. 1958* pp. 127–130, 5 refs. East Malling, 1959.

Psallus ambiguus (Fall.), an important predator of *Panonychus* (*Metatetranychus*) *ulmi* (Koch) on fruit trees in south-eastern England [*cf. R.A.E.*, A **42** 130], is common in unsprayed orchards but usually absent from those receiving a full spray programme. As lime-sulphur is applied at intervals throughout the period during which nymphs of the Mirid are present, the toxicity of this and other fungicides to them was investigated. The following is virtually the author's summary of the results.

Laboratory experiments showed that wet and recently dried deposits of 2·5 per cent. lime-sulphur on apple leaves are highly toxic to second- and third-instar nymphs of *P. ambiguus* when placed in closed glass tubes. Similar experiments in aerated tubes caused no mortality. Tests with hydrogen sulphide gave 100 per cent. kill with a 20-minute exposure to concentrations as low as 208 μg. per litre. From these results it is inferred that the toxicity of lime-sulphur is due to the fumigant action of the hydrogen sulphide evolved. It was also shown that toxicity of the dry deposit decreased with age until, at 48 hours, it caused no mortality. No toxic effects were observed with 5 per cent. captan (N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide) or 4 per cent. dispersible sulphur.

Collyer (E.) & Kirby (A. H. M.). **The Problem of Acaricide-tolerant Strains of the Fruit Tree Red Spider Mite, *Metatetranychus ulmi* (Koch) in south-east England.**—*46th Rep. E. Malling Res. Sta. 1958* pp. 131–139, 3 graphs, 15 refs. East Malling, 1959.

The following is almost entirely the authors' summary. Satisfactory control of *Panonychus* (*Metatetranychus*) *ulmi* (Koch) was obtained in an

apple orchard in Essex in 1954 and 1955 with two post-blossom sprays of either chlorfenson (p-chlorophenyl p-chlorobenzenesulphonate) or chlorbenside (p-chlorobenzyl p-chlorophenyl sulphide). A single pink-bud application of chlorfenson at a heavier rate was ineffective in 1955. Following routine applications of chlorbenside in the same orchard in 1956 and 1957, a heavy winter-egg population was present in 1957–58. Chlorbenside applied post blossom in 1958 failed to kill summer eggs or larvae, or to affect the production or viability of summer eggs laid by sprayed female mites. Chemical determinations showed that chlorbenside was deposited and weathered in a normal manner on leaves from the experimental plots, and laboratory tests showed that eggs laid by female mites taken from trees never sprayed with acaricides largely failed to hatch when exposed to them.

In contrast to the 1958 result with chlorbenside, excellent control was obtained in the same orchard on plots sprayed once in mid-June with amiton [O,O-diethyl S-2(diethylamino)ethyl phosphorothioate], used as the hydrogen oxalate salt. Leaves remained highly toxic to adult female mites and larvae for at least 13 weeks.

The conclusion drawn is that mites now present in this orchard are tolerant of, or resistant to, chlorbenside but not amiton, and it is to be expected that resistance to other acaricides, particularly those of the organophosphorus type, may also appear. The problems associated with this phenomenon are briefly discussed.

Willemse (C.). **On some Tettigonioidea injurious to Coconut Palms.**—*Natuurh. Maandbl.* **47** no. 9–10 pp. 122–125, 3 figs., 5 refs. Maastricht, 1958.

The Tettigoniids here recorded as injuring coconut palms, mainly the leaves, are *Eumossula gracilis* Willemse, in the Lihir Islands, New Britain and Papua, *Segestidea insulana* Willemse in the Lihir group, *S. hanovcrana* Willemse in the Tabar Islands and New Hanover, and *Pseudonicsara szentia*, sp. n., which is described from an adult male taken in Papua. The first of these also attacks the leaves of oil palm (*Elacis guineënsis*) in New Britain.

Papers noticed by Title only.

Kamel (A. H.). **A preliminary List of Insects encountered in stored Drugs in Egypt and their Control.**—*Agric. Res. Rev.* (Engl. edn.) **36** no. 1 pp. 94–95. Cairo, 1958.

Caswell (G. H.). **Observations on the Biology of "** *Callosobruchus maculatus* **" Fabr. (Coleoptera: Bruchidae)** [in cowpeas in Nigeria].—*Comun. Conf. int. Africanistas ocident., S. Tomé* 1956 **4** pp. 103–110. [London] Sci. Coun. Afr. S. Sahara [1958]. (With Summaries in Spanish, French & Portuguese.) [See *R.A.E.*, A **46** 212.]

Moffitt (H. R.). **Rapid Determination of Sex** [by colour] **in** *Rhagoletis* [*suavis var.*] *completa* **Cresson.**—*J. econ. Ent.* **51** no. 4 p. 551, 2 refs. Menasha, Wis., 1958.

MacPhee (A. W.) & Patterson (B. H.). **A Rearing Cabinet with Temperature and Humidity Controls.**—*Canad. Ent.* **90** no. 3 pp. 174–176, 1 fig. Ottawa, 1958.

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